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## ANNALS OF THE CAPE PROVINCIAL MUSEUMS

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*Editor*
Dr F.W. GESS: 1978

# Monograph of *Aulacoderus* la Ferte, a subgenus of *Anthicus* Paykull (Coleoptera: Anthicidae)

by

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## ABSTRACT

Sixty-one new species are described and 55 previously described species are redescribed. The aedeagus and other diagnostic features of each species are illustrated. The 116 species are subdivided into 19 Sections. A key to the males of the Sections and keys to the males of the species within each Section are given. A short discussion is given of 22 previously described species of which insufficient or no material was available.

Four previously described species are found to be synonyms: *A. manzeri* Bonadona, 1967, is a synonym of *A. picheyrei* Peyerimhoff, 1943; *A. middletoniensis* van Hille, 1961, is a synonym of *A. tumefactus* Pic, 1901; *A. subrotundipennis* Pic, 1948, is a synonym of *A. rotundipennis* Pic, 1895; *A. sulcatus* Pic, 1897, is a synonym of *A. funebris* (Reitt), 1884.

*A. bicoloritarsis* Pic, 1948, is probably a synonym of *A. robusticeps* Pic, 1903, however, as no type material of the latter species was available, this question is left open. *A. melitensis* Pic, 1903, has been changed to *A. sulcithorax* Desbr., 1875, subspecies *melitensis* Pic. It occurs on Malta and its anatomical features are identical to those of *A. sulcithorax* Desbr. from Israel but the colour pattern is strikingly different.

## INTRODUCTION

### *THE DEFINITION AND CHARACTERISTICS OF* AULACODERUS

The subgenus *Aulacoderus* was established by M. F. de la Ferté-Sénectère. The subgenotype was *A.* (*A.*) *transversalis* Laf., 1848, but this name was changed to *A.* (*A.*) *mutatus* Gemm., 1870, because *A. transversalis* Villa, 1832, had been previously described.

The definition of *Aulacoderus* is given as follows:

*"Corselet court, le plus souvent transversal, ayant à la base un sillon transversal qui réunit entre elles les fossettes latérales et le divise presque en deux lobes* (*S. G.* Aulacoderus, *nobis*). *Groupe essentiellement sud-africain."* (La Ferté, 1848).

La Ferté described seven species of *Aulacoderus*, of which six are from South Africa and one is from Hungary.

*Aulacoderus* has the following characteristics:

(1) The "sillon transversal" is a dorsal transverse depression or groove near and parallel to the posterior margin of the prothorax. This groove connects the lateral constrictions (fossettes latérales) which are usually filled with, or covered by, long hairs. However, in some species the transverse groove and the lateral constrictions are almost or completely absent (e.g. *A.* (*A.*) *pici* spec. nov. Fig. 363).

(2) The elytra of the male have an apical notch and a pointed apex median to the notch. The notch encloses the opening of a gland, which lies between the two layers of the elytron (van Hille, 1954). The function of this gland is not known, however, it resembles a structure found in some Malachiidae (Evers, 1936). Evers attributes to the gland the function of secreting a sexual attractant.

(3) A physiological character of *Aulacoderus,* not found in other species of the genus *Anthicus,* is the attraction of the males to cantharidin, a substance which occurs in beetles of the family Meloidae. Dead meloid beetles also attract males of the Anthicid genera *Notoxus, Pseudonotoxus, Mecynotarsus* and both sexes of at least some species of *Formicomus.* Many of the species of *Aulacoderus* were collected by using meloid 'bait' with the result that only the males of several species have been found.

Although *Aulacoderus* shares the above discussed three characteristics with *Notoxus* a close relationship between *Aulacoderus* and *Notoxus* has never been considered because *Aulacoderus* lacks a prothoracic horn, the most obvious character of *Notoxus* and related genera. Furthermore, the structure and mechanics of the aedeagus of *Aulacoderus* are essentially different from those of *Notoxus*.

## *NOTE ON TEXT-FIGURES*

The text figures have been drawn, with the aid of a microscope and camera lucida, from specimens mounted in canada balsam. No attempt has been made to produce symmetrical drawings. In some cases deviations from symmetry in drawings of symmetrical structures are caused by the tilt of the object in the mount. All scales are in millimetres.

## *NOTE ON LOCALITIES*

In giving localities the Degree Reference System of Edwards and Leistner as described in Leistner & Morris (1976) is used wherever possible and has been added by the author to the data recorded on the labels.

The basic unit (Fig. 1) is a one-degree square of latitude and longitude designated by a degree Reference Number composed of the degrees of latitude and longitude of its north-west corner. Subdivisions of the one-degree square by successive quarterings provide half- and quarter-degree squares that are named A, B, C, and D from left to right above and then below. Quarter-degree citation involves merely 4 digits and 2 letters, e.g. 2217CC (Fig. 1).

Localities outside southern Africa, and therefore not given in Leistner & Morris, are quoted according to the labels of the specimens.

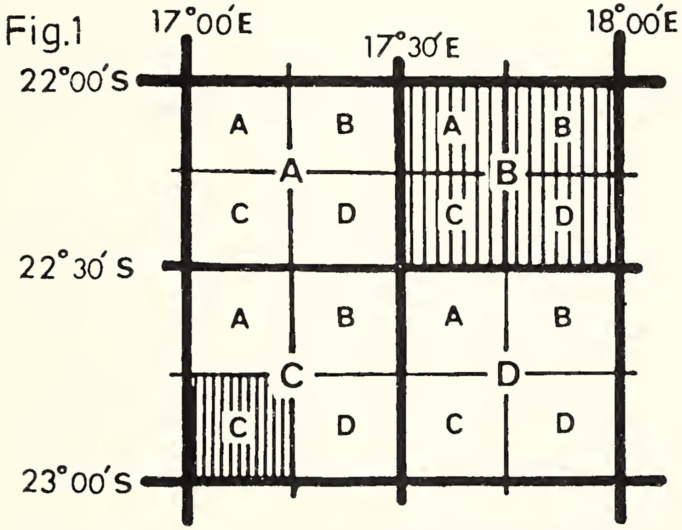
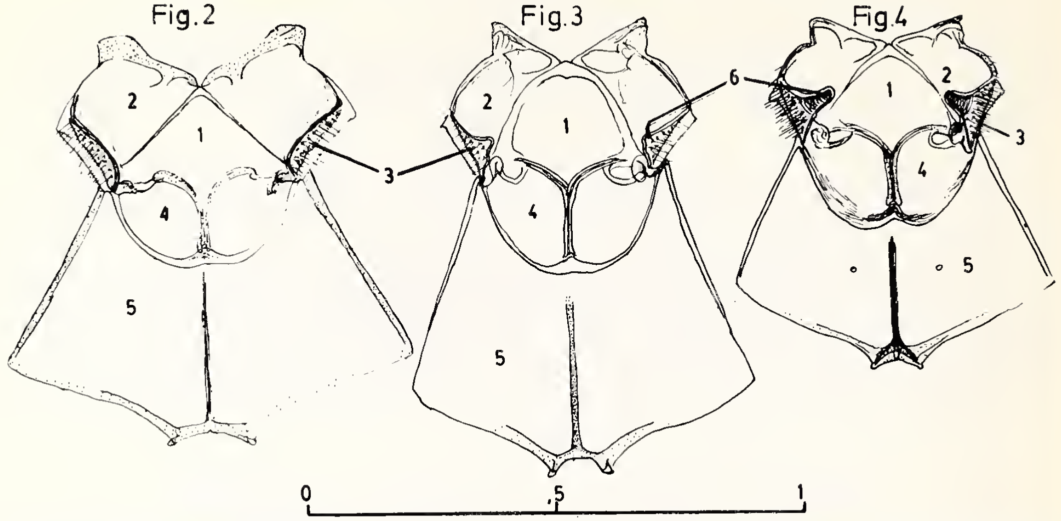


Fig. 1. Example of one-degree square and subdivisions. One-degree square 2217. Half-degree square 2217B. Quarter-degree square 2217CC.

## *MESEPIMERITE APOPHYSES*

In many species of *Aulacoderus* there occurs a structure in the thorax for which the name 'mesepimerite apophysis' has been coined.

The mesepimeron (3 in Figs 2–4) is a narrow sclerite that is immovably fused posteriolaterally onto the mesepisternum (2 in Figs 2–4). The thoracic sclerites are usually sparingly supplied with hairs, however, the mesepimeron has erect hairs over the entire surface. In certain species it has a pair of dorsal inwardly pointing apophyses (6 in Figs 3 and 4). These structures seem to be hollow but to have no apparent opening to the exterior. In most cases their walls



Figs 2–4. Meso- and metathoracic sterna. 2. *A.* (*A.*) *martini* Pic without mesepimerite apophyses. 3. *A.* (*A.*) *seydeli* Pic with reduced mesepimerite apophyses. 4. *A.* (*A.*) *fontium* spec. nov. with well developed mesepimerite apophyses. Key to figures: 1: mesosternum. 2: mesepisternum. 3: mesepimeron. 4: mesocoxal cavities. 6: mesepimerite apophyses.

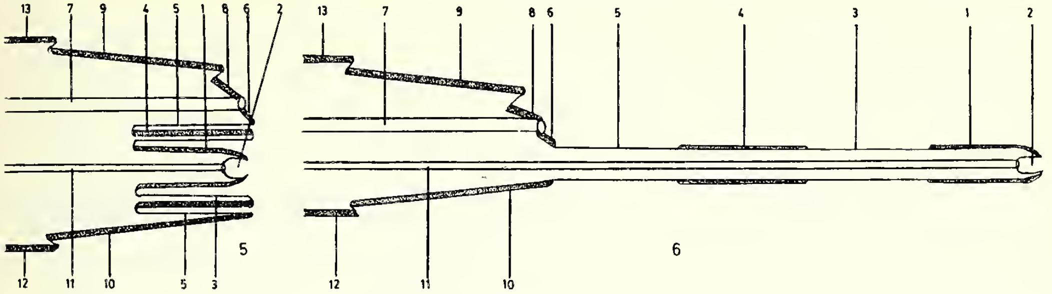
have a spiral strengthening. These apophyses show little variation from species to species, however, in the species of Section 1 they are enlarged and appear as inflated balloons without spiral marking (Figs 13 and 18) and in Section 12 they are reduced (Fig. 3). A function for these apophyses has not been discovered. Neither are muscles attached to them nor are they a pivot for articulation with other internal skeletal structures.

In some species (*A.* (*A.*) *longicornis* (Fig. 245), *A.* (*A.*) *perlucidus* and *A.* (*A.*) *sibayensis*) similar apophyses with spirally strengthened walls occur in the prothorax, pointing inwards from the lateral constrictions. In *A.* (*A.*) *apterus* (Fig. 125) an additional pair of apophyses occurs on the metasternum. In the genus *Notoxus* and in some species of *Anthicus* similar apophyses occur on the first abdominal sternum. These may occur side by side with the mesepimerite apophyses. Presence or absence of mesepimerite apophyses has been used in separating the species of *Aulacoderus* into sections.

### *ABDOMEN AND GENITAL TUBE*

The shape and external features of the species of *Aulacoderus* are rather uniform and pigmentation and size are somewhat variable within the species. The aedeagus and surrounding abdominal segments afford the most reliable diagnostic features. The female genital tube is mainly membranous and has few diagnostic features.

For the naming of the parts of the aedeagus the interpretation of Sharp & Muir (1912) has been followed. Figs 5 and 6, based on Figs 239a and b of Sharp & Muir, are diagrams of the posterior part of the abdomen and of the male genital tube of a generalized beetle. The abdomen consists of ten segments. The aedeagus consists of two sclerotized parts, the median lobe (1) and the tegmen (4) which are connected by the first connecting membrane (3). By means of the second connecting membrane (5) the tegmen is attached dorsally to the tenth sternite (6) and ventrally to the ninth sternite (10).



Figs 5–6. Diagram of posterior part of male abdomen with genital tube of generalised coleopteran, modified from Figs 239a and b of Sharp and Muir (1912). Fig. 5: aedeagus inverted. Fig. 6: aedeagus everted. Key to figures: 1: median lobe. 2: internal sac. 3: 1st connecting membrane. 4: tegmen. 5: 2nd connecting membrane. 6: 10th abdominal sternum. 7: rectum. 8: 10th Abdominal tergum. 9: 9th abdominal tergum. 10: 9th abdominal sternum. 11: ejaculatory duct. 12: 8th abdominal sternum. 13: 8th abdominal tergum.

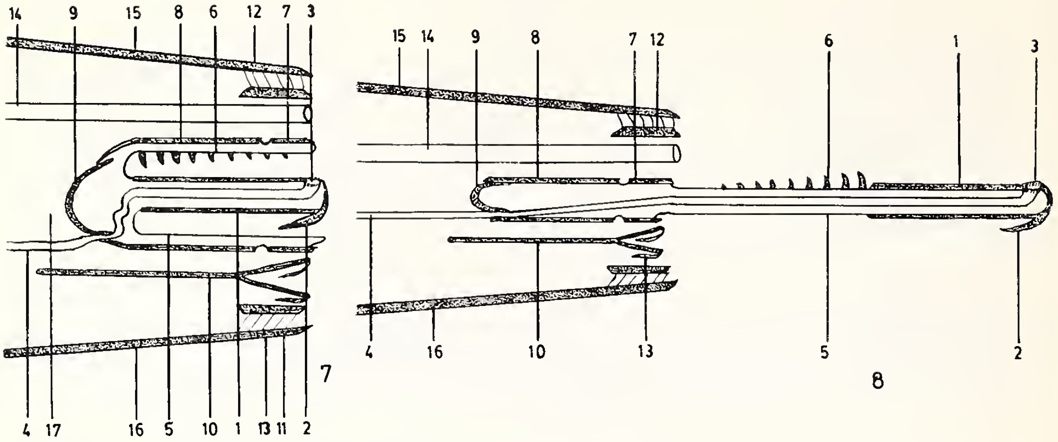
In the resting or inverted position (Fig. 5) the median lobe (1) is surrounded by the first connecting membrane (3) which is surrounded by the tegmen (4) which in turn is surrounded by the second connecting membrane (5). The entire male genital tube lies inside the terminal abdominal segments.

When eversion takes place, the two connecting membranes turn inside out (Fig. 6). The apex of the aedeagus moves backwards over a distance equal to the sum of the lengths of the median lobe (1), the first connecting membrane (3), the tegmen (4), and the second connecting membrane (5).

In the family Anthicidae the abdomen differs from the condition illustrated in Figs 5 and 6. The abdomen consists of five exposed segments and a sixth retracted segment. For the larva of *Anthicus*, Bonadona (1958, Fig. 2a) figures nine abdominal segments and a pygidium. The homologies of the six abdominal segments of the adult anthicid with the nine of the larva and the ten of the generalized beetle are not known. For this reason the abdominal segments of the adult *Aulacoderus* have not been numbered. Only the last two segments are used for diagnostic characters and these are referred to as 'the last exposed segment' and 'the retracted segment'.

In *Aulacoderus* (Figs 7 and 8) the abdominal terga are membranous except for those of the last exposed segment (15) and of the retracted segment (12). The last exposed tergum is lightly sclerotized. In the male it is semicircular or trapezoidal, in the female it is triangular and in some species it has an indented or grooved apex. The last exposed sternum of the male (16) often has useful diagnostic features. The retracted segment lies inside the last exposed segment. In the male the tergum (12) is horseshoe-shaped and the sternum (13) consists of a pair of lightly sclerotized plates except in a few species in which the sternum is a single sclerite. The rectum (14) and the genital tube pass between the tergum and the sternum of the retracted segment. There is no sclerite corresponding to the 10th sternum (6 in Figs 5 and 6) lying between anus and genital tube. In the female tergum and sternum of the retracted segment both consist of paired plates surrounding the rectum and genital tube.

In the male the spiculum gastrale is Y-shaped (10 in Figs 7 and 8). Its distal end, with the Y-arms, lies dorsal to the sternum of the retracted segment (13) and ventral to the aedeagus. In many species the spiculum gastrale has a pair of extraspicular sclerites (11) which articulate with the apex of each Y-arm and are connected to the sternum of the retracted segment by means of fine connective tissue. In the female the spiculum gastrale is a simple bar without apical arms. Sharp & Muir (1912) do not figure the spiculum gastrale in their Figs 239a and b.



Figs 7–8. Diagram of posterior part of male abdomen with genital tube of *Aulacoderus*, Albitarsis Group. Fig. 7: aedeagus inverted. Fig. 8: aedeagus everted. Key to figures: 1: median lobe. 2: ventral spine of 1. 3: genital opening. 4: ejaculatory duct. 5: (1st) connecting membrane. 6: dorsal teeth of 5. 7: apical piece of tegmen. 8: basal piece of tegmen. 9: basal cup of tegmen. 10: spiculum gastrale. 11: extra-spicular sclerites of 10. 12: tergum of retracted abdominal segment. 13: sternum of retracted abdominal segment. 14: rectum. 15: last exposed abdominal tergum. 16: last exposed abdominal sternum. 17: connective tissue.

The aedeagus of *Aulacoderus* consists of a median lobe (1 in Figs 7 and 8), a first connecting membrane (5) and a tegmen (7, 8 and 9). The median lobe is a single sclerite which has the genital opening dorsally, apically or subapically. In the species of Sections 7 and 8 it has a ventral apical or subapical spine (3). The first connecting membrane (5) is attached to the base of the median lobe and to the apical region of the tegmen. In the species of Sections 1–8 it has a dorsal row of teeth (6) which point inwards and backwards when the aedeagus is inverted and outwards and forwards when it is everted. The teeth strengthen the connecting membrane without impeding its movement and anchor the aedeagus in the female during copulation. The tegmen consists of an apical (7) and a basal piece (8) and a basal cap (9). The latter is thimble-shaped and fits loosely into the base of the tegmen and usually falls off when the aedeagus is manipulated during preparation. The ejaculatory duct (4) enters the aedeagus ventrally to the basal cap.

There is no second connecting membrane between the base of the tegmen and the body-wall.

The spiculum gastrale (10) lies directly ventral to the aedeagus. Connective tissue (17) surrounds the base of the aedeagus and the base of the spiculum gastrale. The spiculum gastrale to which the tegmen is anchored is itself anchored in the abdomen by its attachment to the sternum of the retracted segment. The connective tissue allows a slight movement of the tegmen to contribute to the eversion of the aedeagus, however, the main eversion takes place over a distance which equals the sum of the lengths of the median lobe and the first connecting membrane.

### *PARALLEL SCLERITES*

The species of Section 5 have a pair of elongate slender sclerites which lie dorsally to and parallel to the median lobe of the aedeagus and which are called the ‘parallel sclerites’.

The parallel sclerites may be longer (Fig. 120) or shorter (Fig. 143) than the median lobe.

They may be fused at the base forming an elongate V-shaped structure (Fig. 158). At the apex they may be forked (Fig. 153) or have hooks or spines (Fig. 166). They are not attached to the median lobe but to the distal region of the connecting membrane. If they are short, they may turn upside down when the connecting membrane turns inside out (Fig. 79), however, it is unlikely that this would occur in the live insect.

## *ABBREVIATIONS OF NAMES OF DEPOSITORIES OF MATERIAL STUDIED*

The following is a list of abbreviations of Museums and other institutions from which the author has had material on loan and where identified material is deposited.

| | |
|---|---|
| AMSA | Albany Museum, Grahamstown, South Africa. |
| BMNH | British Museum (Natural History), London, England. |
| ITZA | Institute for Taxonomic Zoology, Div. Entomology, University of Amsterdam, Nederland. |
| MNHN | Muséum National d'Histoire Naturelle, Paris, France. |
| MRAC | Museé Royal de l'Afrique Centrale, Tervuren, Belgium. |
| MSNG | Museo Civico di Storia Naturale, Giacomo Doria, Genoa, Italy. |
| NCI | National Collection of Insects, Plant Protection Research Institute, Pretoria, South Africa. |
| NHMP | Natural History Museum, Prague, Czechoslovakia. |
| NMW | Naturhistorisches Museum, Vienna, Austria. |
| SAM | South African Museum, Cape Town, South Africa. |
| TMP | Transvaal Museum, Pretoria, South Africa. |
| UEML | University Entomological Museum, Lund, Sweden. |
| ZEUH | Zoology Department, Division of Entomology, University of Helsinki, Finland. |
| ZSBM | Zoologische Sammlung des Bayrischen Staates, München, West Germany. |

## KEY TO SECTIONS OF *AULACODERUS*

In a previous paper on some Anthicidae collected in South Africa (van Hille, 1961), nine species of *Aulacoderus* were described or redescribed and the aedeagus was used as a diagnostic character for the first time. As the structure of the aedeagus in that material was found to show essential differences, the species were divided into three groups: the Albitarsis Group, the Martini Group and the Flavopictus Group.

In a paper on the Anthicidae of northern Zululand (van Hille, 1971), five more species of *Aulacoderus* were described or redescribed. Four species were placed in the Albitarsis Group and a fifth, *A. pedester* van Hille in the Martini Group because of its short and broad aedeagus.

With the large amount of material available for the present work, it was found that many species did not fit into any of the three groups proposed in 1961. The species are now divided into 18 sections, based upon the abdominal features of the male. An additional section, Section 19, is an assemblage of unrelated species which do not fit into any of the other 18 sections.

The Albitarsis Group is now represented by Sections 1–8. The division into sections is based on secondary characters. About half of the known species of *Aulacoderus* belong to these eight sections.

The Martini Group is represented by Section 15, however, it was found that *A. pedester* is not closely related to the species in this section. Together with some similar species it is now placed in Section 10.

The Flavopictus Group is represented by Section 16.

All keys use male structures as diagnostic characters and thus cannot be used for identification of females.

| | | |
|---|---|---|
| 1 | With mesepimerite apophyses | 2 |
| — | Without mesepimerite apophyses | 15 |
| 2 | Mesepimerite apophyses roundly inflated at apex (Fig. 13) | Section 1 |
| — | Mesepimerite apophyses not inflated | 3 |
| 3 | Connecting membrane of aedeagus with dorsal teeth | 4 |
| — | Connecting membrane of aedeagus without dorsal teeth | 10 |
| 4 | Distal tooth of connecting membrane of aedeagus articulating with lower part of median lobe (Fig. 31) | Section 2 |
| — | Distal tooth of connecting membrane of aedeagus not articulating with median lobe | 5 |
| 5 | Spiculum gastrale of male with simple Y-arms | 6 |
| — | Spiculum gastrale of male with forked Y-arms (Fig. 42) | Section 3 |
| 6 | Spiculum gastrale of male with sclerite between Y-arms (Fig. 58) | Section 4 |
| — | Spiculum gastrale of male without sclerite between Y-arms | 7 |
| 7 | Aedeagus with parallel sclerites (Fig. 120) | Section 5 |
| — | Aedeagus without parallel sclerites | 8 |
| 8 | Median lobe of aedeagus with ventral apical or subapical spine | 9 |
| — | Median lobe of aedeagus without ventral apical or subapical spine | Section 6 |
| 9 | Median lobe of aedeagus with simple narrow ventral spine (Fig. 232) | Section 7 |
| — | Median lobe of aedeagus with broad or complex ventral spine (Figs 271 and 289) | Section 8 |
| 10 | Median lobe of aedeagus with ventral proximally recurved hook (Fig. 353); last exposed abdominal sternum of male with apical excavation with median distally pointing grooved process (Fig. 355) | Section 14 |
| — | Median lobe of aedeagus without ventral hook | 11 |
| 11 | Sternum of retracted abdominal segment of male with two pairs of hooks (Figs 301 and 305); aedeagus small | Section 9 |
| — | Sternum of retracted abdominal segment of male without two pairs of hooks | 12 |
| 12 | Aedeagus short and broad | 13 |
| — | Aedeagus elongate | 14 |
| 13 | Wings reduced or absent | Section 10 |
| — | Wings fully developed | Section 11 |
| 14 | Last exposed abdominal sternum of male consisting of a pair of sclerites (Fig. 327) | Section 12 |
| — | Last exposed abdominal sternum of male consisting of single sclerite | Section 13 |
| 15 | Sternum of retracted segment of male consisting of pair of slender backward pointing spikes (Figs. 392) | Section 15 |
| — | Sternum of retracted abdominal segment of male not consisting of pair of slender spikes | 16 |
| 16 | Median lobe of aedeagus with slender pointed sclerotized bar | 17 |
| — | Median lobe of aedeagus without slender sclerotized bar | 18 |
| 17 | Tegmen of aedeagus elongate; median lobe short and membranous with narrow genital opening; apex of sclerotized bar lying immediately proximal to genital opening | Section 16 |
| — | Slender sclerotized bar has narrow oval genital opening at its apex and thus represents the median lobe (Fig. 431) | Section 17 |
| 18 | Tergum of retracted abdominal segment of male with a pair of short thick spines (Fig. 441); median lobe of aedeagus membranous except for a sclerotized base; con- | |

necting membrane of aedeagus with small pustules (Fig. 440) ................ Section 18
— Tergum of retracted abdominal segment of male and median lobe of aedeagus otherwise ........................................................................ Section 19

## DEFINITION OF SECTIONS, KEYS TO AND DESCRIPTIONS OF SPECIES BY SECTION

### SECTION 1

The three species in this section are testaceous with a dark transverse band in the middle of the elytra. The prothorax is angular in outline and the angles may be accentuated by lateral points or spines. The mesepimerite apophyses look as if they are inflated and they have no spiral markings. The tergum of the retracted abdominal segment of the male has a proximally pointing flap with a marginal row of fenestrae. The aedeagus is large, about 1 mm long, and complicated in structure. All the species are from the Transvaal, South Africa.

### Key to the species of Section 1

1 Sternum of retracted abdominal segment of male consists of a pair of hooks pointing inwards (Fig. 12) ........................................................ *thabinensis*
— Sternum of retracted abdominal segment of male consists of a pair of flat plates ..... 2
2 Connecting membrane of aedeagus unarmed; basal piece of tegmen shorter than apical piece ............................................................................ *erratus*
— First connecting membrane of aedeagus with dorsal field of teeth (Fig. 20); basal piece of tegmen of aedeagus longer than apical piece ...................... *spinithorax*

*Anthicus (Aulacoderus) thabinensis* **spec. nov.**, Figs 9–13

Size. Length 2,41 mm (2,25–2,65); width over broadest part of elytra 0,98 mm (0,87–1,05).

*Head* (Fig. 9). Glossy, dark testaceous; posterior arch round. Closely punctate, with procumbent hairs. Eyes somewhat bulging.

*Prothorax* (Fig. 9). Glossy, testaceous, lighter than head; slightly broader than long, broader than head; with three pairs of lateral angles, each with a long erect hair. Punctures almost as close as on head, but fewer and finer on basal region. With light recumbent hairs. Lateral constrictions at ⅔ of the length of the prothorax, with long silvery hairs.

*Elytra*. Glossy, testaceous, with dark transverse band in the middle not quite reaching median suture. Elongate, broadest in front of middle. Punctures less close than on prothorax, with recumbent silvery hairs longer and closer than on prothorax and a number of erect and semi-erect hairs. In male, with small apical point and oblique notch.

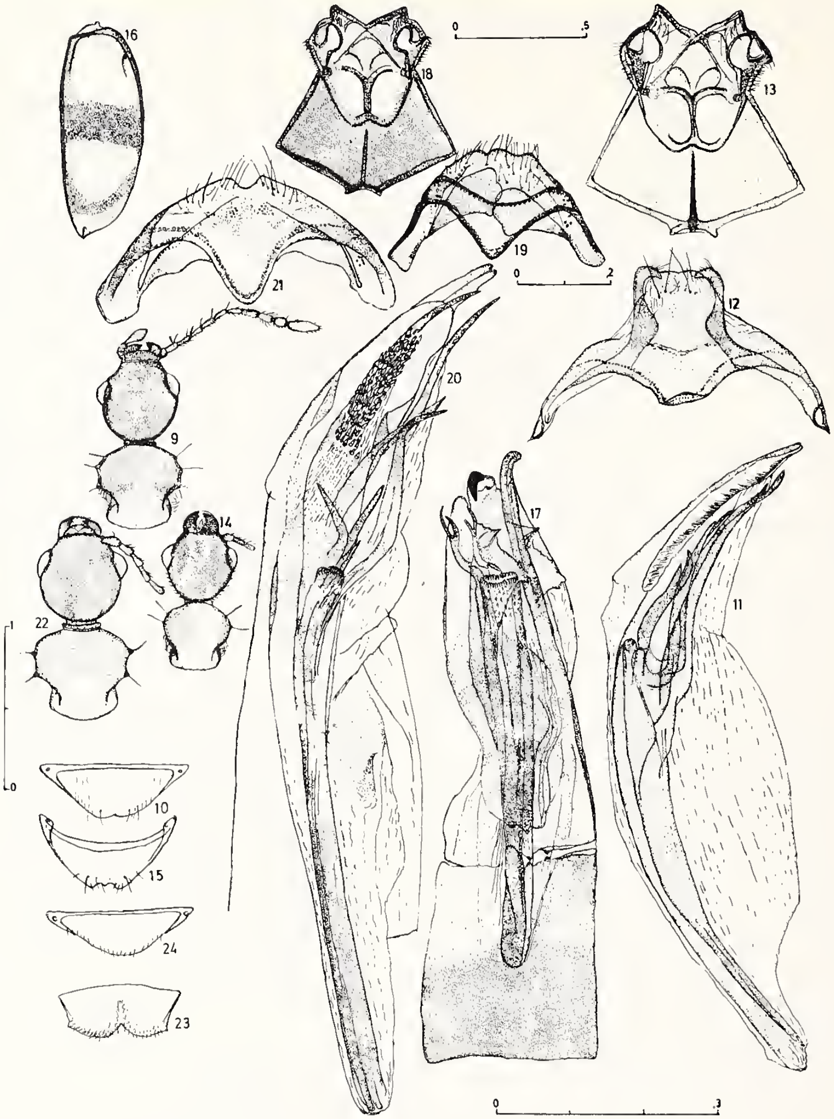
*Wings*. Fully developed.

*Antennae* (Fig. 9). Testaceous, slender, apical three or four segments darker and slightly thicker. Last segment a little longer than two preceding ones together.

*Legs*. Testaceous.

*Undersurface*. Testaceous. With large oval mesepimerite apophyses without spiral markings (Fig. 13).

*Male abdomen*. Aedeagus (Fig. 11): median lobe slender with three pairs of pointed spines attached at different levels and all pointing distally; connecting membrane with large number of teeth arranged in a dorsal series of about 28 short transverse rows of 3–5 teeth each; tegmen very slightly sclerotized, apical piece ending in two short blunt lobes; basal piece longer than apical piece. Retracted segment (Fig. 12): tergum with flat apex, very slightly indented and with a median proximally pointing flap with marginal row of fenestrae; sternum consisting



Figs 9–24. Section 1. *A.* (*A.*) *thabinensis* spec. nov. 9: head and prothorax. 10: last exposed abdominal sternum of male. 11: aedeagus. 12: retracted abdominal segment of male. 13: thoracic sterna showing enlarged mesepimerite apophyses. *A.* (*A.*) *erratus* spec. nov. 14: head and prothorax. 15: last exposed abdominal sternum of male. 16: elytron of male. 17: aedeagus. 18: thoracic sterna showing enlarged mesepimerite apophyses. 19: retracted abdominal segment of male. *A.* (*A.*) *spinithorax* spec. nov. 20: aedeagus. 21: retracted abdominal segment of male. 22: head and prothorax. 23: last exposed abdominal tergum of male. 24: last exposed abdominal sternum of male.

of a pair of hooks pointing inwards. Last exposed sternum (Fig. 10) apically flat with very slight indentation.

Material examined. South Africa: Thabina, Zpb. Dist. [2330CD], xi.1905, Holotype ♂, Paratypes 1 ♂, 2 ♀♀, (C. Zwierstra) (AMSA).

*Anthicus (Aulacoderus) erratus* **spec. nov.**, Figs 14–19.

Size. Length 2,35 mm; width over broadest part of elytra 0,82 mm.

*Head* (Fig. 14). Glossy, dark testaceous; posterior arch longitudinally oval. Distinctly punctate with procumbent hairs. Eyes large and bulging.

*Prothorax* (Fig. 14). Glossy, dark testaceous but not as dark as head. Longer than broad, narrower than head. Shoulders angular; with two long erect lateral hairs on each side. With prominent lateral constrictions connected by a shallow depression over the dorsal surface.

*Elytra* (Fig. 16). Glossy, testaceous, with a broad dark transverse band across the anterior middle region and a narrower dark subapical band. Punctures prominent with recumbent hairs and a number of erect hairs, especially along the lateral margins.

*Wings*. Fully developed.

*Antennae*. Testaceous; apical 3–4 segments gradually broader but not darker; last segment as long as two preceding ones together.

*Legs*. Testaceous.

*Undersurface*. Dark testaceous, abdomen darker than thorax. Mesepimerite apophyses (Fig. 18) large and round, without spiral markings.

*Male abdomen*. Aedeagus (Fig. 17): median lobe slender with dark mark at apex; genital opening round at apical fifth, with beaded margin and a pair of ventral forked horns; connecting membrane attached to proximal quarter of median lobe, with a lateral membranous lobe on either side of the median lobe, with blunt apex and serrated dorsal margin; tegmen with apical piece twice as long as basal piece. Retracted segment (Fig. 19): tergum with trilobed hairy apex and bluntly pointed proximal region with two transverse rows of fenestrae; sternum consisting of a pair of broad triangular plates. Last exposed sternum (Fig. 15) with apical indentation with small median point.

Material examined. South Africa: Louis Trichardt [2329BB], grass netting, 14.iii.1973, Holotype ♂, Paratype ♀, (S. Endrödy-Younga) (TMP); no locality, no date, Paratypes 1 ♂, 1 ♀, (A. L. Capener) (AMSA). These specimens were received together with other material collected in the Transvaal between 1940 and 1953.

*Anthicus (Aulacoderus) spinithorax* **spec. nov.**, Figs 20–24

Size. Length 3,01 mm (2,82–3,20); width over broadest part of elytra 0,95 mm (0,90–1,00).

*Head* (Fig. 22). Glossy, testaceous; posterior arch round; punctures prominent with short procumbent hairs. Eyes bulging.

*Prothorax* (Fig. 22). Glossy, testaceous; slightly broader than long, broader than head; with two pairs of lateral points or spines, each with an erect hair. Punctures bigger than on head but finer on posterior area; with short recumbent hairs. Lateral constrictions prominent at ¾ of the length of the prothorax, connected by a transverse dorsal groove.

*Elytra*. Glossy, testaceous with dark transverse band in the middle, not reaching the median suture. Elongate. Punctures more widely spaced than on prothorax, with long coarse recumbent hairs.

*Wings*. Fully developed.

*Antennae*. Testaceous; apical four segments slightly broader than but not darker than other segments.

*Legs*. Testaceous.

*Undersurface*. Testaceous, mesepimerite apophyses enlarged as in the two preceding species.

*Male abdomen*. Aedeagus (Fig. 20): median lobe with elongate proximal stalk; genital opening on distal half, round with beaded margin; with four pairs of spines, distal to genital opening, increasing in length from proximal to distal, all pointing distally; connecting membrane with a field of about 15 transverse rows of 6 teeth each in Holotype, but in Paratype there are 3 parallel longitudinal rows of 10–12 teeth each; tegmen with a pair of blunt apical lobes, basal piece longer than apical piece. Retracted segment (Fig. 21); tergum with round apical indentation and some long hairs and with a proximal median flap with submarginal row of fenestrae, becoming a double row laterally; sternum consists of a pair of plates meeting at the median line. Spiculum gastrale with widely diverging Y-arms, somewhat recurved at apex. Last exposed tergum (Fig. 23) with median apical indentation. Last exposed sternum (Fig. 24) with blunt apex.

MATERIAL EXAMINED. South Africa: Barberton [2531CC], to Nelspruit [2530BD], 14–15.x.1930, Holotype ♂, (D. L. Uyttenboogaart) (ITZA); Z. A. 70, Barbeton (*sic*) District, Barbeton (*sic*), humus, x.1961, Paratype ♂, (N. Leleup) (TMP).

## SECTION 2

In the two species of this section the dorsal row of teeth of the connecting membrane of the aedeagus articulates with the basal part of the median lobe by means of an elongate sclerite which is probably a modification of one or more of the dorsal teeth.

Both species were collected on the South African south coast.

### Key to the species of Section 2

1 Connecting membrane of aedeagus with dorsal row of about 23 teeth (Fig. 25) . . . *flavitarsis*

— Connecting membrane of aedeagus with dorsal row of about 14 teeth (Fig. 31) . . . . *perna*

*Anthicus (Aulacoderus) flavitarsis* Fåhr., Figs 25–28

*Anthicus flavitarsis* Fåhraeus, 1870: 335

Size. Length 1,80 mm (1,77–1,82); width over broadest part of elytra 0,66 mm (0,65–0,67).

*Head* (Fig. 26). Glossy, black; posterior arch broadly transverse; punctures moderately prominent with fine grey hairs pointing transversely to the median line. Eyes small and little bulging.

*Prothorax* (Fig. 26). Somewhat glossy, dark testaceous to black, lighter at base; broader than long, as broad as head; shoulders round; lateral constrictions not very prominent, with short hairs and connected by a transverse basal dorsal groove. Punctures closer than on head, with recumbent hairs slightly coarser than on head.

*Elytra*. Mat, dark testaceous with small lighter pair of maculae at posterior quarter, only visible when viewed in transmitted light. Shoulders round. Punctures less close than on prothorax, with recumbent hairs, longer than on prothorax.

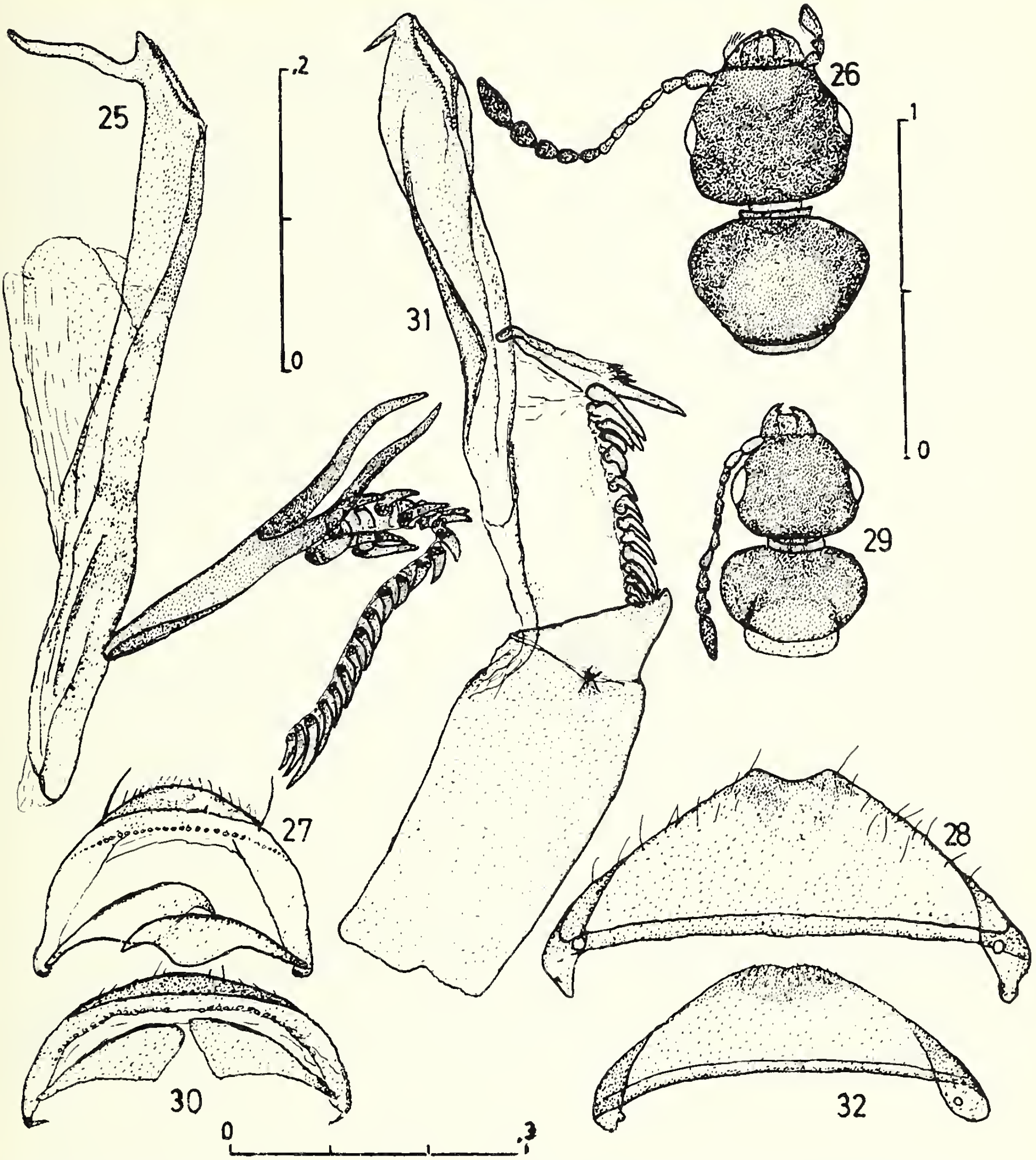
*Wings*. Fully developed.

*Antennae*. Dark testaceous, segments two to five or six lighter (Fig. 26).

*Legs*. Testaceous; coxae, femora and two apical tarsal segments darker.

*Undersurface*. Dark testaceous, abdomen darker than thorax.

*Male abdomen*. Aedeagus: median lobe (Fig. 25) with apical backwards pointing ventral spine and apical genital opening with beaded margin; connecting membrane with dorsal row of about 23 teeth of which the distal one is very much larger than the others and is forked at



Figs 25–32. Section 2. *A.* (*A.*) *flavitarsis* Fåhr. 25: median lobe of aedeagus with part of connecting membrane with row of teeth. 26: head and prothorax. 27: retracted abdominal segment of male. 28: last exposed abdominal sternum of male. *A.* (*A.*) *perna* spec. nov. 29: head and prothorax. 30: retracted abdominal segment of male. 31: aedeagus, everted. 32: last exposed abdominal sternum of male.

apex; this tooth articulates with the dorsal side of the median lobe at its basal quarter; tegmen with short apical piece and long basal piece. Retracted segment (Fig. 27): tergum with round apex and dark transverse line between apex and row of fenestrae; sternum consisting of a pair of apically pointed sclerites. Last exposed sternum (Fig. 28) with shallow apical indentation.

MATERIAL EXAMINED. South Africa: Cape of Good Hope, Table Mountain [3318CD], 1906, 2♂♂, (W. Bevins) (named) (BMNH); Newlands, Cape, 99 Kildare Road [3318CD], 19.xi.1979, 20 ♂♂, (J. C. van Hille) (AMSA); Newlands, Cape, Rhodes Drive [3318CD], 19.xi.1979, 20 ♂♂, (J. C. van Hille) (AMSA): Cape Town, Table Mountain [3318CD], 21.xi.1979, 20 ♂♂ (J. C. van Hille) (AMSA); Kirstenbosch [3318CD], 22.xi.1979, 1 ♂, (J. C. van Hille) (AMSA); Cape Point Nature Reserve [3418AD], 23.xi.1979, 20♂♂, (J. C. van Hille) (AMSA). All specimens collected by author were attracted to meloid bait.

The identification of this species is doubtful. It is not known who identified the specimens in the British Museum. All the specimens examined are from the Cape Peninsula whereas the Type locality is Caffraria, which is the area in the eastern Cape Province, east of the Great Fish River. However, the name Caffraria has been used loosely. The name *flavitarsis* is inappropriate as in most specimens the last two tarsal segments are somewhat dark.

Also in the British Museum is a female specimen, labelled *A. flavitarsis*, from Mossel Bay 3422AA, 1924, R. E. Turner. It looks different from the Table Mountain specimens and it is suspected that it is a different species.

*Anthicus (Aulacoderus) perna* **spec. nov**., Figs 29–32

Size. Length 1,70 mm; width over broadest part of elytra 0,70 mm.

*Head* (Fig. 29). Glossy, dark testaceous to black; posterior arch straight and transverse with rounded angles to eyes; punctures close, with fine procumbent hairs. Eyes somewhat bulging.

*Prothorax* (Fig. 29). Glossy, dark testaceous but lighter at base; broader than long, broader than head; strongly narrowing to base; shoulders round; lateral constrictions not prominent, with short hairs and connected by a transverse dorsal groove. Punctures close, with recumbent hairs.

*Elytra*. Glossy, testaceous, lighter than prothorax; rather broad with round shoulders. Punctures prominent with fine recumbent hairs.

*Wings*. Fully developed.

*Antennae* (Fig. 29). Testaceous, slender, apical segments gradually thicker and darker; last segment as long as two preceding ones together.

*Legs*. Testaceous; coxae, femora and two distal tarsal segments darker.

*Undersurface*. Dark, testaceous, abdomen darker than thorax.

*Male abdomen*. Aedeagus (Fig. 31): median lobe with short apical ventral spine and apical genital opening with beaded margin; connecting membrane with dorsal row of about 14 teeth, of which the distal one is much enlarged and articulates with the proximal third of the median lobe; tegmen with basal piece three and a half times as long as apical piece. Retracted segment (Fig. 30): tergum semi-circular with transverse dark line and parallel row of fenestrae, shortly interrupted in the middle; sternum consisting of a pair of elongate triangular plates. Last exposed sternum (Fig. 32) with small shallow apical indentation.

MATERIAL EXAMINED. South Africa: Mossel Bay [3422AA], xii.1934, ♂ Holotype, (R. E. Turner) (BMNH).

## SECTION 3

The four species of this section are characterized by forked arms of the spiculum gastrale. Three species are from the western Cape Province, one species from the eastern Transvaal.

### Key to the species of Section 3

| | | |
|---|---|---|
| 1 | Spiculum gastrale asymmetrical (Fig. 34) | *asymmetricus* |
| — | Spiculum gastrale symmetrical | 2 |
| 2 | Median lobe of aedeagus with subapical, backward pointing ventral spine with small teeth (Fig. 36) | *smithi* |
| — | Median lobe of aedeagus without ventral spine | 3 |
| 3 | Median lobe of aedeagus with blunt dorsal hump immediately proximal to genital opening (Fig. 32) | *atronitidus* |
| — | Median lobe of aedeagus with sharp dorsal tooth immediately proximal to genital opening (Fig. 45) | *spiculosus* |

*Anthicus* (*Aulacoderus*) *asymmetricus* **spec. nov.**, Figs 33–35

Size. Length 1,97 mm (1,60–2,30); width over broadest part of elytra 0,75 mm (0,68–0,87).

*Head.* Glossy, dark testaceous to black; posterior arch broadly round. Punctures distinct with prominent procumbent hairs; a pair of long lateral erect hairs half-way between eyes and neck. Eyes somewhat bulging.

*Prothorax.* Dark testaceous, the base lighter; broader than long, broader than head. Punctures distinct but finer and fewer on posterior quarter, with recumbent hairs. Lateral constrictions at ¾ of length of prothorax, with fine long hairs.

*Elytra.* Somewhat glossy, dark testaceous to black; with distinct dark punctures and some light punctures with longer semi-erect hairs.

*Wings.* Fully developed.

*Antennae.* Slender, testaceous, the apical three segments darker; last segment shorter than two preceding ones together.

*Legs.* Testaceous, coxae and femora darker.

*Undersurface.* Dark testaceous, abdomen almost black, thoracic sternites lighter.

*Male abdomen.* Aedeagus (Fig. 33): median lobe slender, almost straight; with fine apical point and subapical genital opening with finely beaded margin; proximal to genital opening the median lobe broadens and has a dorsal proximal pointing hook; connecting membrane with dorsal row of about 19 teeth; distal to these teeth is a region with about 16 short dark transverse ridges; tegmen with basal piece about five times as long as apical piece. Spiculum gastrale (Fig. 34): each of the Y-arms has a median branch, however, the right one is broader and longer than the left one and has on its median side two small teeth of which the proximal one has two points. Retracted segment (Fig. 35): tergum with broadly round apex with eight to ten stiff hairs; it has a transverse row of fenestrae and ends laterally in a pair of broad lobes; sternum consists of a pair of broad, lightly sclerotized plates. Last exposed sternum with small and shallow apical indentation.

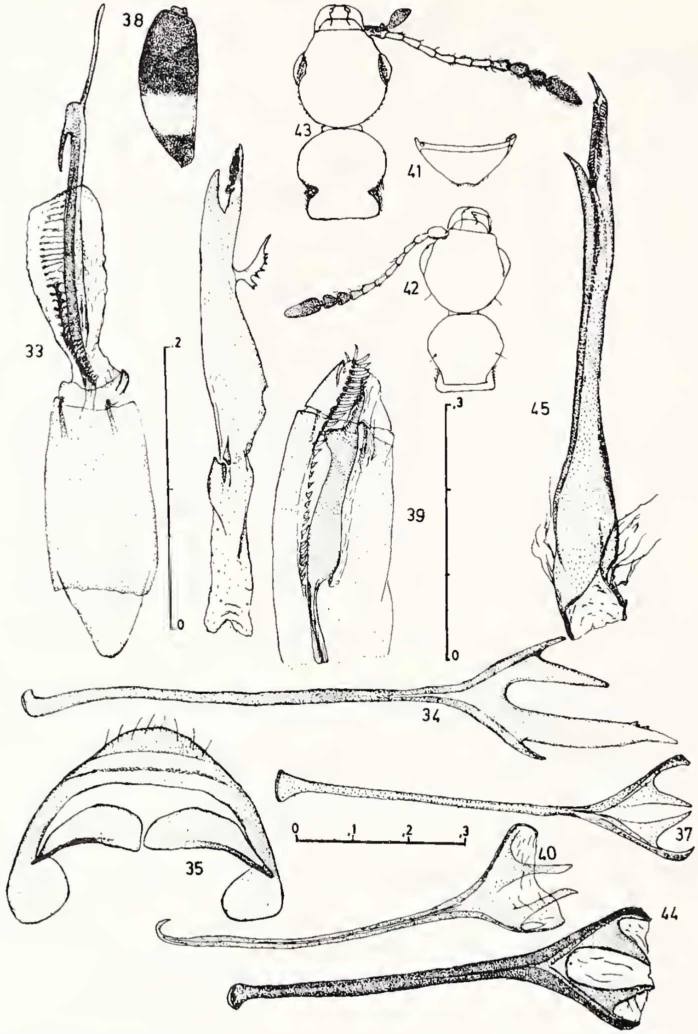
MATERIAL EXAMINED. South Africa: Sudwala Caves near White River [2531AC], along path from ticket office to entrance of cave, to meloid bait, 29.xi.1979, Holotype ♂, Paratypes 4 ♂♂, (J. C. van Hille) (AMSA).

*Anthicus (Aulacoderus) smithi* **spec. nov.**, Figs 36–38.

Size. Length 2,12 mm (2,05–2,14); width over broadest part of elytra 0,86 mm (0,82–0,93).

*Head.* Glossy, black; posterior arch round; with fine punctures with rather long coarse black hairs and several lateral erect hairs between eyes and neck. Eyes bulging.

*Prothorax.* Glossy, black; longer than broad, narrower than head. Shoulders sloping and round. Punctures fine with coarse black recumbent hairs. Posterior area testaceous with few



Figs 33–45. *A.* (*A.*) *asymmetricus* spec. nov. 33: aedeagus, everted. 34: spiculum gastrale of male. 35: retracted abdominal segment of male. *A.* (*A.*) *smithi* spec. nov. 36: median lobe of aedeagus. 37: spiculum gastrale of male. 38: elytron of male. *A.* (*A.*) *atronitidus* Laf. 39: aedeagus, inverted. 40: spiculum gastrale of male. 41: last exposed abdominal sternum of male. 42: head and prothorax. *A.* (*A.*) *spiculosus* spec. nov. 43: head and prothorax. 44: spiculum gastrale of male. 45: median lobe of aedeagus.

punctures and few hairs. Lateral constrictions at $\frac{3}{4}$ of length of prothorax, with fine light grey hairs.

*Elytra* (Fig. 38). Glossy, black with a pair of light maculae behind the middle and with indistinct indication of a lighter area on the shoulders. Punctures fine with dark hairs as long as those on prothorax but with light hairs on shoulders and maculae; with a number of light erect hairs.

*Wings*. Fully developed

*Antennae*. Testaceous, apical three segments dark testaceous to black and broader; last segment shorter than two preceding ones together.

*Maxillary palps*. Dark testaceous to black.

*Legs*. Testaceous, distal half of femora slightly darker.

*Undersurface*. Dark testaceous.

*Male abdomen*. Aedeagus: median lobe (Fig. 36) with short broad dorsal spine, attached proximally to genital opening, pointing distally, and a subapical ventral spine with about eight ventral teeth; connecting membrane with about 32 single dorsal teeth; tegmen with basal piece almost four times as long as apical piece. Retracted segment: tergum with transverse row of fenestrae; sternum consisting of a pair of thin narrow plates. Spiculum gastrale (Fig. 37) Y-shaped, each arm of Y with median triangular spine which is hardly sclerotized at the base. Last exposed sternum apically flat and somewhat indented.

MATERIAL EXAMINED. South Africa: Piketberg Mountain [3218DA], 27.vii.1977, Holotype ♂, Paratypes 1 ♂, 1 ♀, (M. W. Mansell) (AMSA); Clanwilliam, Cedarberg [3218BB], vii.1957, Paratype 1 ♂, (J. Smith) (MRAC); Clanwilliam, Cedarberg [3218BB], in humus, (N. Leleup) (MRAC).

*Anthicus (Aulacoderus) atronitidus* Laf., Figs 39–42

*Anthicus (Aulacoderus) atronitidus* La Ferté-Sénectère, 1848: 270

Size. Length 2,03 mm (1,95–2,19); width over broadest part of elytra 0,71 mm (0,64–0,75).

*Head* (Fig. 42). Glossy, dark testaceous to black; posterior arch round; punctures distinct, not very close, with sparse procumbent hairs; a pair of erect lateral hairs halfway between eyes and neck. Eyes slightly bulging.

*Prothorax* (Fig. 42). Glossy, dark testaceous to black, lighter at base; longer than broad, narrower than head. Shoulders sloping and round; lateral constrictions at $\frac{3}{4}$ of length of prothorax, not very distinct and only slightly hairy. Punctures distinct but sparse with fine recumbent hairs and a pair of erect dorso-lateral hairs half-way along the length of prothorax.

*Elytra*. Glossy, dark testaceous to black; elongate with round shoulders; punctures well spaced with recumbent hairs, longer than those on prothorax, and about 24 remarkably long erect hairs on each elytron, evenly spaced over the whole surface.

*Wings*. Fully developed in males, reduced in females.

*Antennae*. (Fig. 42). Dark testaceous, apical 3–4 segments broader. Last segment longer than two preceding ones together.

*Legs*. Dark testaceous; tibiae and tarsi slightly lighter.

*Undersurface*. Dark testaceous to black.

*Male abdomen*. Aedeagus (Fig. 39): median lobe with apical point; genital opening elongate with finely grooved margin; with a blunt dorsal lobe proximal to genital opening; connecting membrane with about 34 single dorsal teeth; tegmen with basal piece four times as long as apical piece. Retracted segment: tergum apically round with dark transverse line and parallel row of fenestrae; sternum consisting of a pair of slightly sclerotized plates, overlapping in the middle. Spiculum gastrale (Fig. 40) Y-shaped, each arm of Y with elongate median process. Last exposed sternum (Fig. 41) slightly indented at apex.

MATERIAL EXAMINED. South Africa: Cape of Good Hope, no date, 2 ♂♂, (C. Darwin) (BMNH). No locality, no date, 1 ♂, 1 ♀ (no collector) (NMW). No locality, no date, 2 specimens on one card, (no collector) (MNHN) with two labels: '*A. flavitarsis* Fahr.?' and '*atronitidus* Laf.', both labels in Pic's handwriting.

The two specimens collected by Darwin, from the unidentified material in the British Museum, are an interesting curiosity. They must have been collected between May 31 and June 18, 1836, which was the period spent by Darwin at the Cape on the home journey of the Beagle. Professor V. S. Forbes informed the author that during this time Darwin made an expedition of several days from Cape Town to Paarl Rock and via French Hoek and Sir Lowry's Pass back to Cape Town. One of the specimens has an acquisition label of the British Museum with the date 1885, two years after Darwin's death.

In addition to the above specimens the author has seen 2 ♂♂ (South Africa, Citrusdal [3219CA], on leaves of orange trees, 19.iv.1953, (V. B. Whitehead) (AMSA)) which have a large testaceous macula on the posterior half of each elytron; it reaches the lateral margin but not the median suture. The genitalia and other features are as in *A. atronitidus*. Similar colour variations, especially in males, occur in *A. bicoloritarsis* Pic and in *A. recognitus* Pic.

*Anthicus (Aulacoderus) spiculosus* **spec. nov.**, Figs. 43–45

Size. Length 2,35 mm (2,20–2,48); width over broadest part of elytra 0,97 mm (0,92–1,02).

*Head* (Fig. 43). Glossy, black; posterior arch round; with fine punctures and dark procumbent hairs. Eyes slightly bulging.

*Prothorax* (Fig. 43). Glossy, black but posterior area testaceous; as long as broad, narrower than head. Shoulders round. With well developed lateral constrictions at ¾ of the length of the prothorax. Punctures fine with recumbent hairs and a few erect hairs.

*Elytra*. Dark testaceous to black; elongate, with fine punctures and recumbent hairs, longer than on prothorax; with a number of longer erect hairs.

*Wings*. Fully developed in male, reduced in female.

*Antennae* (Fig. 43). Testaceous, first and apical four or five segments darker.

*Legs*. Testaceous; coxae and femora darker.

*Undersurface*. Dark testaceous.

*Male abdomen*. Aedeagus: median lobe (Fig. 45) slender, slightly curved; with elongate genital opening with beaded margin; with short apical point and immediately proximal to the genital opening a slightly larger dorsal point; connecting membrane with dorsal row of about 36 single teeth; tegmen with basal piece longer than apical piece. Retracted segment: tergum with subapical transverse dark line and a more proximal parallel row of fenestrae; sternum consisting of a pair of curved plates, narrow at the attachment to the tergum, broader and round at apex. Spiculum gastrale (Fig. 44) Y-shaped, each arm of the Y with a median triangular hook. Last exposed sternum with flat apex, very slightly indented.

MATERIAL EXAMINED. South Africa: Matjesfontein [3320BA], 6.x.1928, Holotype ♂, Paratypes 1 ♂, 1 ♀, (R. E. Turner) (BMNH).

## SECTION 4

The seven species of this section have an interspicular sclerite, which lies in the membrane which connects the arms of the Y-shaped spiculum gastrale.

The prothorax has angular shoulders. The median lobe of the aedeagus is slender and the connecting membrane has between 12–25 dorsal teeth. The species occur in South Africa: Eastern Cape Province, Natal and Transvaal.

### Key to the species of Section 4

1 Median lobe of aedeagus with dorsal distally pointing arm, almost half the length of median lobe (Fig. 46) .................................................. *mogotoensis*
— Median lobe of aedeagus without dorsal arm .................................. 2

2 Sternum of retracted abdominal segment of male consists of a pair of roundish sclerites which have a fringe of 8–12 soft spines on dorsal side (Fig. 50) ...... *canthariphilus*

— Sternum of retracted abdominal segment of male without fringe of soft spines ....... 3

3 Sternum of retracted abdominal segment of male consists of a pair of sclerotized slender angular hooks pointing backwards (Figs 57, 60 and 63) ........................ 4

— Sternum of retracted abdominal segment of male otherwise ........................ 6

4 Median lobe of aedeagus with short dorsal hook immediately proximal to genital opening (Figs 59 and 64) ................................................ 5

— Median lobe of aedeagus without dorsal hook immediately proximal to genital opening (Fig. 55) ................................................ *scotti*

5 Interspicular sclerite oval, apically split into two for ⅔ of its length (Fig. 58) ..... *pallidithorax*

— Interspicular sclerite broadly triangular, mainly sclerotized at the distal margin (Fig. 66) ................................................ *firmani*

6 Sternum of retracted abdominal segment of male consists of a pair of thin broad plates, each with a short subapical pigmented spine (Fig. 68); median lobe of aedeagus with small pointed tooth immediately proximal to genital opening (Fig. 67) .. *capeneri*

— Sternum of retracted abdominal segment of male consists of a pair of broad sharply pointed sclerites (Fig. 77); median lobe of aedeagus slender and simple (Fig. 75) .... *fontium*

*Anthicus (Aulacoderus) mogotoensis* **spec. nov.**, Figs 46–47

Size. Length 2,10 mm (1,94–2,22); width over broadest part of elytra 0,73 mm (0,70–0,75).

*Head.* Glossy, very dark testaceous to black; posterior arch broadly transverse. Punctures distinct with dark procumbent hairs. Eyes bulging.

*Prothorax.* Glossy, dark testaceous but with posterior third lighter; broader than long, slightly broader than head. Shoulders angular, each with long erect lateral hair; another pair of erect lateral hairs half-way between shoulders and lateral constrictions and also a pair on dorsal surface. Punctures as on head, with dark recumbent hairs but indistinct on posterior third. Lateral constrictions at ¾ of the length of the prothorax, not connected by a transverse groove or depression.

*Elytra.* Glossy, dark testaceous with two pairs of lighter maculae: anterior pair behind shoulders, sometimes only showing near lateral margin, posterior pair behind middle, reaching median suture and almost reaching lateral margin. Punctures distinct, those near median suture with dark margin; with dark recumbent hairs but with light hairs on the anterior maculae; with a number of erect or semi-erect hairs implanted in light transparent punctures. In male with small apical point and short round notch.

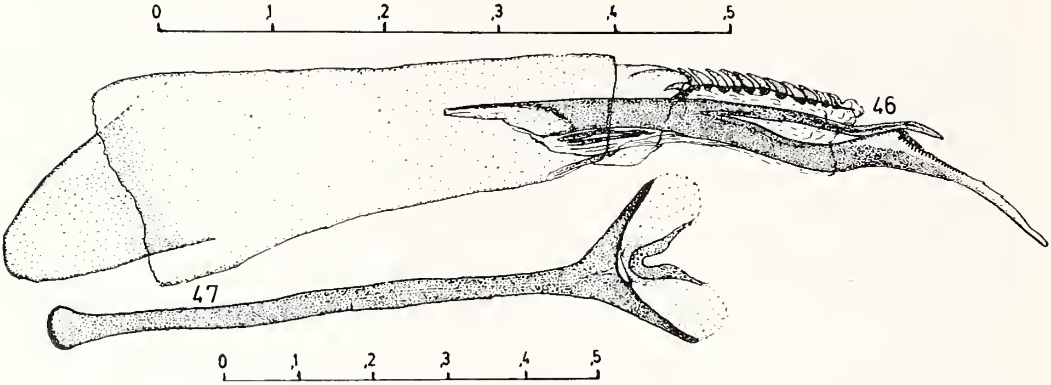
*Wings.* Fully developed.

*Antennae.* Rather slender, light testaceous but three apical segments broader and darker; last segment shorter than two preceding ones together.

*Legs.* Testaceous, coxae and femora darker.

*Undersurface.* Dark testaceous to black.

*Male abdomen.* Aedeagus (Fig. 46): median lobe elongate with long apical point and long subapical genital opening with beaded margin; with pointed dorsal branch, attached to proximal half of median lobe and extending to half-way the length of genital opening; connecting membrane with dorsal row of about 14 teeth; tegmen with basal piece about six times as long as apical piece. Retracted segment: tergum horseshoe-shaped with dark hairy apex, with dark transverse line and a more proximal parallel row of fenestrae; sternum consisting of a pair of elongate plates. Spiculum gastrale (Fig. 47) with short diverging Y-arms between which lies a U-shaped interspicular sclerite. Last exposed sternum with small and shallow apical indentation.



Figs 46–47. *A.* (*A.*) *mogotoensis* spec. nov. 46: aedeagus. 47: spiculum gastrale of male.

Material examined. South Africa: Mogoto, Zebediela [2429AC], 24.x.1979, to meloid bait, Holotype ♂, Paratypes 4 ♂♂, (M. W. Mansell) (AMSA), Paratypes 2 ♂♂ (M. W. Mansell) (NCI).

*Anthicus (Aulacoderus) canthariphilus* **spec. nov.,** Figs 48–52

Size. Length 2,20 mm (1,80–2,53); width over broadest part of elytra 0,84 mm (0,73–0,91).

*Head.* Glossy, testaceous; posterior arch broadly round; punctures well spaced with dark procumbent hairs. Eyes small and bulging.

*Prothorax.* Glossy, slightly lighter than head; broader than long, as broad as head. Shoulders sloping with pointed lateral angles with erect hair; a second pair of erect hairs laterally between shoulders and base. Punctures as on head but scarce on basal area; hairs recumbent.

*Elytra* (Fig. 51). Glossy, light testaceous with dark area in the middle, not reaching median suture nor lateral margins, apex also darker. Punctures well spaced with fine recumbent hairs and a number of longer erect and semi-erect hairs.

*Wings.* Fully developed.

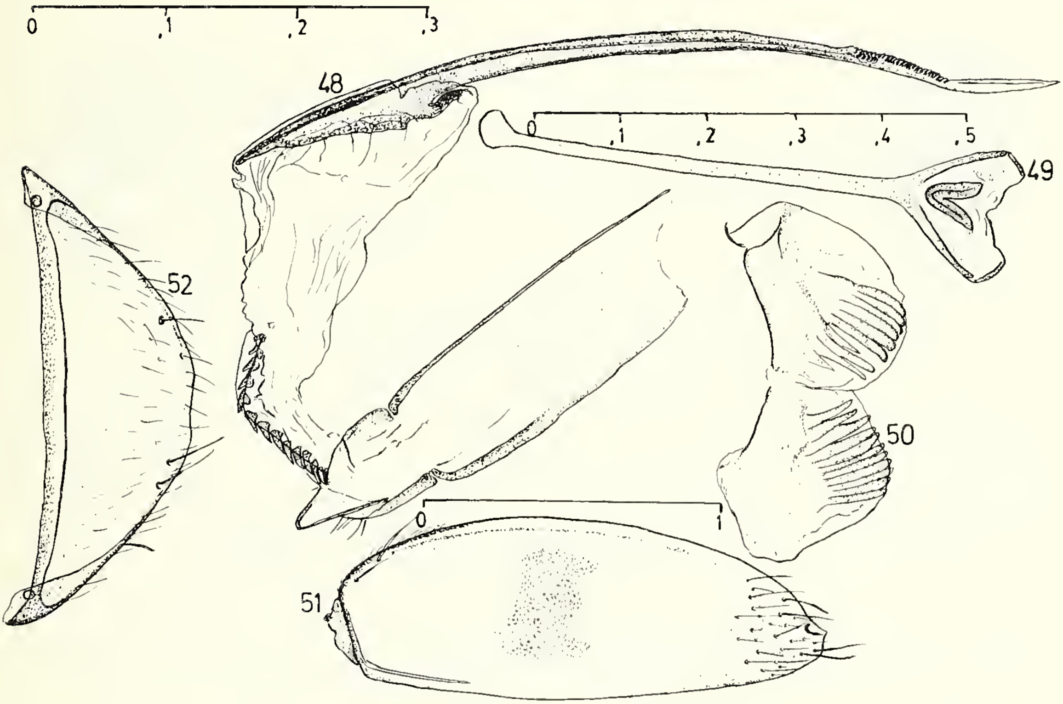
*Antennae.* Light testaceous, last three segments darker, especially last segment but its tip is light; last three segments broader; last segment shorter than two preceding ones together.

*Legs.* Light testaceous.

*Undersurface.* Light testaceous to testaceous, abdomen darker than thorax.

*Male abdomen.* Aedeagus (Fig. 48): median lobe long and slender, ventrally concave; with long apical point and elongate subapical genital opening with beaded margin; connecting membrane with dorsal row of 13–16 single teeth; tegmen: apical piece with pointed apex; basal piece two and a half times as long as apical piece. Retracted segment: tergum apically round with proximal transverse row of fenestrae and dark stippled transverse line between fenestrae and apex; sternum (Fig. 50) consisting of pair of sclerites with fringe of 8–12 broad spines on dorsal surface; the number of these spines may vary even between right and left side in one specimen. Spiculum gastrale (Fig. 49) with V-shaped interspicular sclerite. Last exposed sternum (Fig. 52) apically flat.

Material examined. South Africa: Grahamstown, Rhodes University grounds [3326BC], 7.x.1952, to meloid bait, Holotype ♂, (J. C. van Hille) (AMSA); Grahamstown [3326BC], Rhodes University Grounds, Belmont Valley, Howieson's Poort, Mosslands, to meloid bait,



Figs 48–52. *A.* (*A.*) *canthariphilus* spec. nov. 48: aedeagus. 49: spiculum gastrale of male. 50: sternum of retracted abdominal segment of male. 51: elytron of male. 52: last exposed abdominal sternum of male.

Paratypes 86 ♂♂, (J. C. van Hille) (AMSA); Stutterheim [3227CB], near Kalogha Forest 21.ii.1954, Paratypes 2 ♂♂, (E. McC. Callan) (AMSA); Bedford [3226CA], Kelvinside, Cowie Valley, to meloid bait, Paratypes 12 ♂♂, (J. C. van Hille) (AMSA); Sedgefield [3422BB], to meloid bait, Paratype 1 ♂, (J. C. van Hille) (AMSA).

*Anthicus (Aulacoderus) scotti* **spec. nov.,** Figs 53–57

Size. Length 2,15 mm; width over broadest party of elytra 0,75 mm.

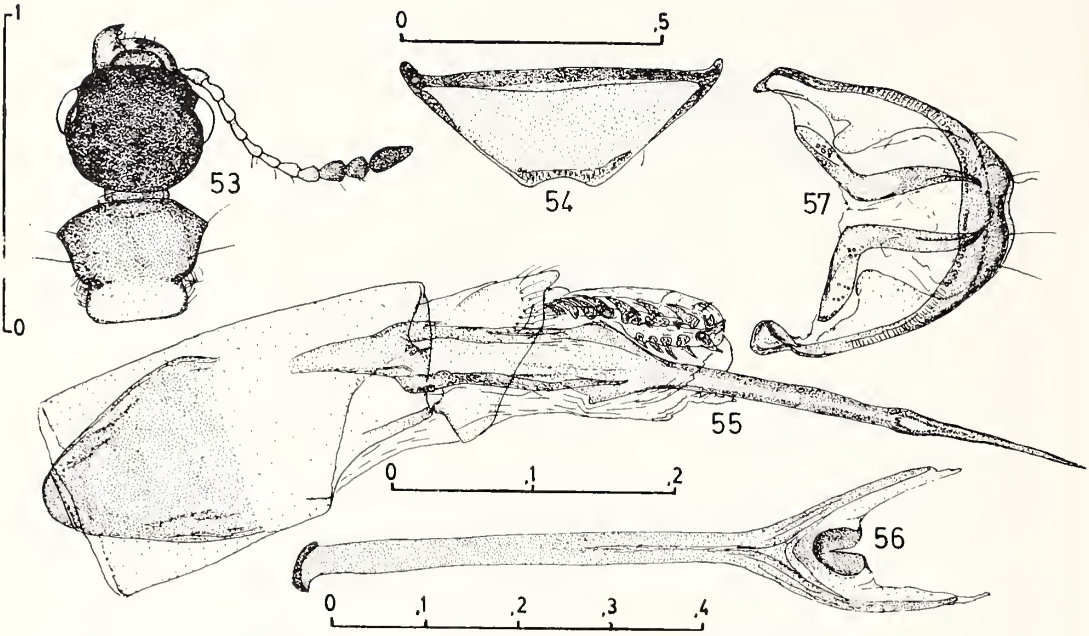
*Head* (Fig. 53). Glossy, black; posterior arch broadly round; punctures with fine procumbent hairs. Eyes bulging.

*Prothorax* (Fig. 53). Glossy, light testaceous, lighter at base; as long as broad, as broad as head. Shoulders sloping, sharply angular with a long erect hair each; second pair of erect hairs half-way between shoulders and base. Punctures as on head but absent on basal area, with fine recumbent hairs. Lateral constrictions at $\frac{2}{3}$ of the length of the prothorax.

*Elytra.* Glossy, dark testaceous to black, short and oval; shoulders round and well developed. Punctures near median suture with large dark spot behind each puncture, in some cases whole puncture surrounded by dark area; with fine recumbent hairs; a number of erect hairs implanted in larger punctures. Male with small apical point and oblique notch.

*Wings.* Fully developed.

*Antennae* (Fig. 53). Testaceous, last three segments darker and broader; last segment as long as two preceding ones together.



Figs 53–57. *A.* (*A.*) *scotti* spec. nov. 53: head and prothorax. 54: last exposed abdominal sternum of male. 55: aedeagus. 56: spiculum gastrale of male. 57: retracted abdominal segment of male.

*Legs*. Testaceous, coxae darker, especially of hind legs.

*Undersurface*. Thorax dark testaceous, abdomen black.

*Male abdomen*. Aedeagus (Fig. 55): median lobe: proximal half rather broad, apical half slender with long, finely pointed apex; genital opening subapical, narrowly oval with finely beaded margin; connecting membrane with dorsal row of 15 teeth of which the middle ones have a small additional tooth on each side; tegmen light in colour and slightly sclerotized; basal piece three times as long as apical piece; basal cap darker. Retracted segment (Fig. 57): tergum apically slightly indented, with subapical transverse row of fenestrae, interrupted in median area; sternum consisting of a pair of inwards and backwards pointing hooks. Spiculum gastrale (Fig. 56) Y-shaped, with small dark interspicular sclerite. Last exposed sternum (Fig. 54) with shallow apical indentation.

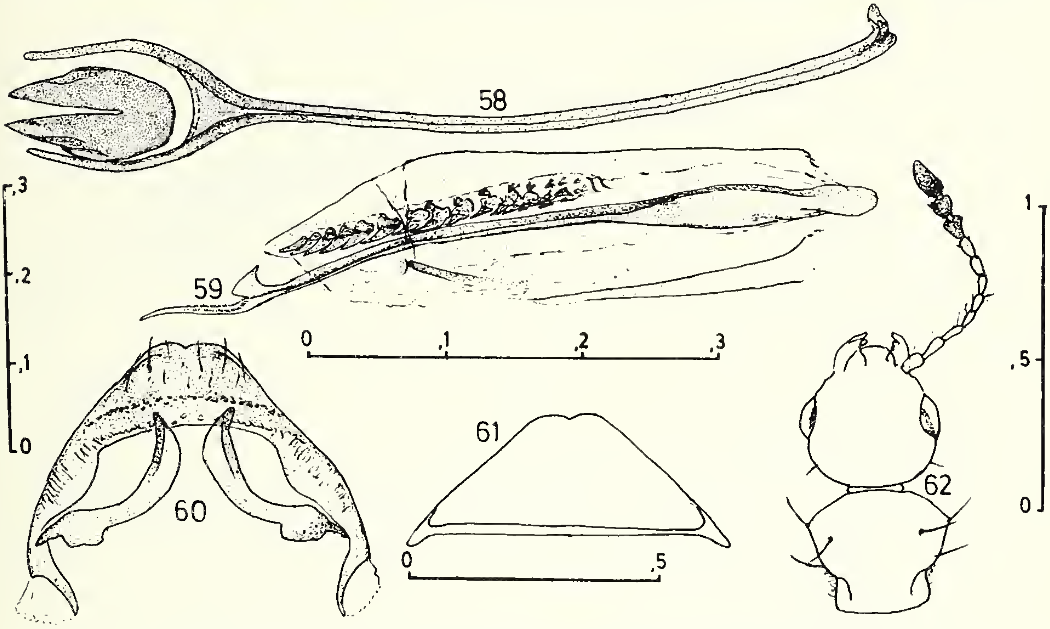
Material examined. South Africa: 1929–290, Holotype ♂, (Dr Hugh Scott) (BMNH).

*Anthicus (Aulacoderus) pallidithorax* **spec. nov.,** Figs 58–62

Size. Length 2,04 mm (1,87–2,07); width over broadest part of elytra 0,72 mm (0,69–0,75).

*Head* (Fig. 62). Glossy, dark testaceous; posterior arch broadly round; with pair of lateral erect hairs half-way between eyes and neck. With fine punctures with short procumbent hairs. Eyes small, only slightly bulging.

*Prothorax* (Fig. 62). Glossy, light testaceous to testaceous; broader than long, slightly broader than head; front round with angular shoulders, each with long erect hair; other erect hairs, implanted in large punctures, laterally between shoulder and base and dorsally on ante-



Figs 58–62. *A.* (*A.*) *pallidithorax* spec. nov. 58: spiculum gastrale of male. 59: aedeagus. 60: retracted abdominal segment of male. 61: last exposed abdominal sternum of male. 62: head and prothorax.

rior half. Other punctures fine with fine recumbent hairs. Lateral constrictions at ¾ of the length of the prothorax, with fine long hairs.

*Elytra.* Glossy, dark testaceous with vaguely outlined lighter areas on shoulders and behind middle. Densely punctured with grey recumbent hairs and a number of erect and semi-erect longer hairs, implanted in larger punctures.

*Wings.* Fully developed.

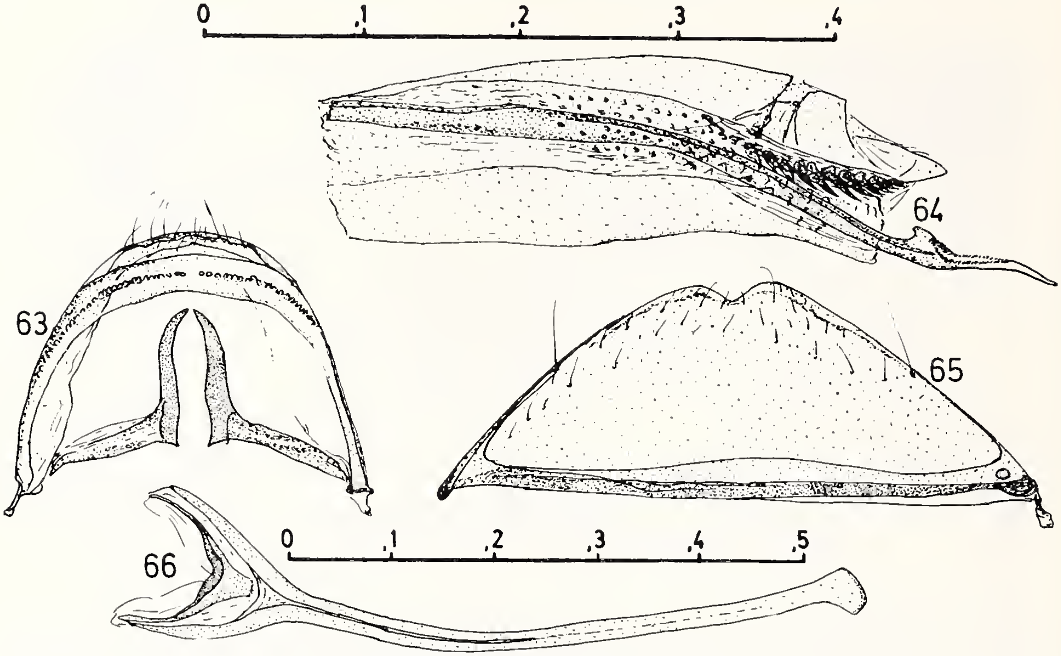
*Antennae* (Fig. 62). Light testaceous, apical three segments darker and broader; last segment shorter than two preceding ones together.

*Legs.* Light testaceous.

*Undersurface.* Testaceous, thorax lighter than abdomen.

*Male abdomen.* Aedeagus (Fig. 59): median lobe very slender with broad forward pointing hook immediately proximal to narrow genital opening; connecting membrane with dorsal row of about 15 teeth of which those nearest to attachment to base of median lobe occur in transverse rows of three; tegmen: basal piece more than three times as long as pointed apical piece. Retracted segment (Fig. 60): tergum rather broad with transverse row of fenestrae; sternum consisting of a pair of curved pointed sclerites. Spiculum gastrale (Fig. 58) with oval interspicular sclerite which is split for more than two thirds of its length by an apical incision. Last exposed sternum (Fig. 61) rather long with small apical incision.

MATERIAL EXAMINED. South Africa: Natal, Van Reenen [2829AD], xii.1926, Holotype ♂, Paratypes 7 ♂♂, (R. E. Turner) (BMNH); Natal, Hilton Road [2930CB], i.1954, Paratype ♂, (P. Graham) (AMSA); Natal, Tweedie [2930AC], i.1948, Paratype ♂, (J. Tully) (AMSA).



Figs 63–66. *A.* (*A.*) *firmani* spec. nov. 63: retracted abdominal segment of male. 64: aedeagus. 65: last exposed abdominal sternum of male. 66: spiculum gastrale of male.

*Anthicus (Aulacoderus) firmani* **spec. nov.**, Figs 63–66

Size. Length 1,87 mm (1,70–2,00); width over broadest part of elytra 0,73 mm (0,65–0,78).

*Head.* Somewhat glossy, testaceous to dark testaceous; posterior arch round; punctures distinct with fine procumbent hairs. Eyes with narrow black margin, slightly bulging.

*Prothorax.* Glossy, testaceous; broader than long, as broad as head. Shoulders sloping and angular and with another pair of lateral blunt angles between shoulders and base; each angle with long erect hair. Punctures closer than on head, with fine recumbent hairs but posterior region without punctures and hairs. Lateral constrictions at $\frac{3}{4}$ of the length of the prothorax, with fine long hairs.

*Elytra.* Somewhat glossy, lighter than prothorax; narrowing from anterior third to apex; with transverse dark band in front of middle, apex also darker. Punctures less close than on prothorax, with recumbent hairs and a number of longer semi-erect hairs, especially on posterior half.

*Wings.* Fully developed.

*Antennae.* Testaceous, apical three segments hardly darker but slightly broader than proximal segments; last segment shorter than two preceding ones together.

*Legs.* Testaceous.

*Undersurface.* Testaceous, thorax lighter than abdomen.

*Male abdomen.* Aedeagus (Fig. 64): median lobe slender, with long apical point; genital opening subapical, with beaded margin and proximal forward pointing hook; connecting membrane with dorsal row of about 15 teeth, each with a small denticle on each side; near attachment to base of median lobe is an area with small pustules; tegmen: apical piece dorsally pointed, basal piece three times as long as apical piece. Retracted segment (Fig. 63): tergum with flat apex, fine transverse dark line and a more proximal transverse row of fenestrae; sternum consisting of a pair of inwards and backwards pointing hooks. Spiculum gastrale (Fig. 66) lightly sclerotized, with interspicular sclerite. Last exposed sternum (Fig. 65) with small round apical indentation.

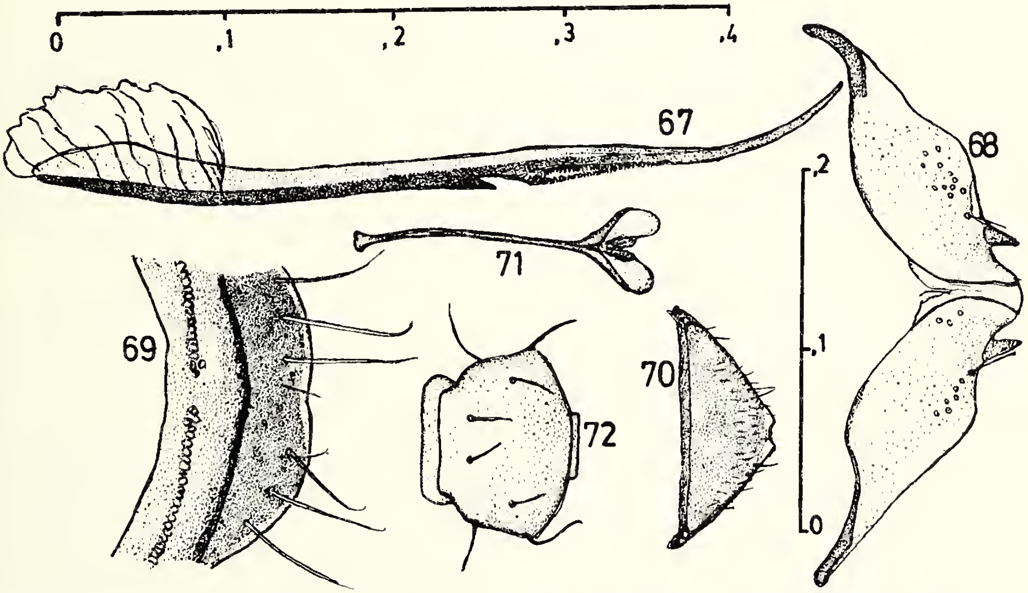
MATERIAL EXAMINED. South Africa: Blaauwkrans, Sandyford (now Elysium) [2829DD], Harrismith, under debris in donga, 10.ii.1894, Holotype ♂, (G. A. K. Marshall) (BMNH). Paratypes unlabelled (except one which has a label '*Anthicus* det. G. E. Bryant'), 6 specimens, (NCI).

*Anthicus (Aulacoderus) capeneri* **spec. nov.**, Figs 67–72

Size. Length 2,11 mm (2,00–2,25); width over broadest part of elytra 0,78 mm (0,73–0,82).

*Head.* Glossy, very dark testaceous to black; posterior arch broadly round, laterally diverging to eyes; with fine punctures with short procumbent hairs. Eyes slightly bulging.

*Prothorax* (Fig. 72). Glossy, testaceous to dark testaceous; broader than long, broader than head; front round with angular shoulders, each with an erect hair; another pair of erect hairs laterally half-way between shoulders and posterior margin and two more pairs of erect hairs on dorsal surface, implanted in larger punctures than those of recumbent hairs. Punctures closer than on head but fewer and smaller at base, with fine short hairs. Lateral constrictions at $\frac{4}{5}$ of the length of the prothorax, with fine hairs and connected by transverse dorsal groove.



Figs 67–72. *A.* (*A.*) *capeneri* spec. nov. 67: median lobe of aedeagus. 68: sternum of retracted abdominal segment of male. 69: detail of tergum of retracted abdominal segment of male. 70: last exposed abdominal sternum of male. 71: spiculum gastrale of male. 72: prothorax.

*Elytra.* Somewhat glossy, testaceous to dark testaceous with two pairs of lighter maculae, vague in outline; elongate and narrow. Punctures more widely spaced than on prothorax, with recumbent hairs, longer than on prothorax and with a number of erect hairs implanted in larger punctures than those of recumbent hairs.

*Wings.* Fully developed.

*Antennae.* Testaceous, apical three segments darker and broader; last segment shorter than two preceding ones together.

*Legs.* Testaceous, distal half of femora darker.

*Undersurface.* Dark testaceous.

*Male abdomen.* Aedeagus: median lobe (Fig. 67) slender, with long apical point; genital opening subapical, elongate with finely beaded margin and small distally pointing hook, proximal to genital opening; connecting membrane with dorsal row of 12 single teeth; tegmen slightly sclerotized with basal piece about three times as long as apical piece. Retracted segment: tergum (Fig. 69) with subapical transverse dark line and parallel row of fenestrae, interrupted in median area; sternum (Fig. 68) consisting of a pair of plates, each with dark short subapical spine. Spiculum gastrale (Fig. 71) with small interspicular sclerite. Last exposed sternum (Fig. 70) rather long, with shallow apical indentation.

MATERIAL EXAMINED. South Africa: Pretoria, Fountains [2528CC], 31.x.1951. Holotype ♂, Paratypes 5 ♂♂, (A. L. Capener) (AMSA).

*Anthicus (Aulacoderus) fontium* **spec. nov.,** Figs 73–78

Size. Length 1,96 mm (1,83–2,13); width over broadest part of elytra 0,82 mm (0,72–0,88).

*Head.* (Fig. 73). Glossy, dark testaceous to black; posterior arch round. Punctures with narrow dark margin and short procumbent hairs; four pairs of longer erect hairs: one pair laterally half-way between eyes and neck and three pairs on dorsal surface. Eyes bulging.

*Prothorax* (Fig. 73). Glossy, testaceous; broader than long, almost as broad as head; shoulders sloping and angular, each with an erect lateral hair; another pair of erect lateral hairs half-way between shoulders and base and three pairs on dorsal surface. Punctures fine with recumbent hairs, punctures of erect hairs larger. Lateral constrictions at $\frac{3}{4}$ of the length of the prothorax, with fine hairs.

*Elytra.* Glossy, usually plain dark testaceous to black but in some specimens with somewhat vague indication of lighter area on shoulders and at apex (Fig. 74); females often less dark than males. Punctures fine with fine recumbent hairs; larger punctures with erect or semi-erect hairs distributed over the whole surface.

*Wings.* Fully developed.

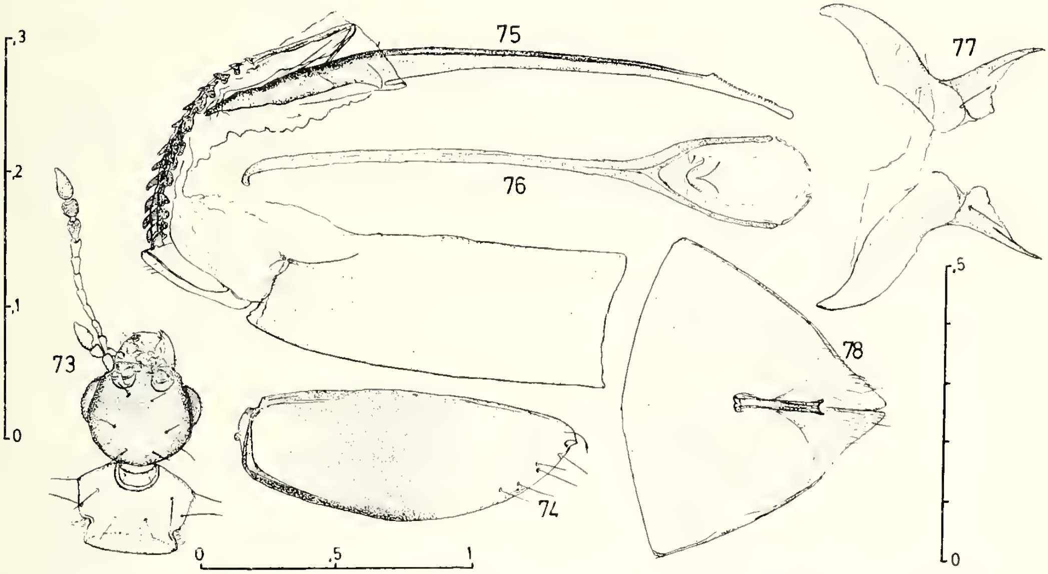
*Antennae.* (Fig. 73). Testaceous, three apical segments darker and somewhat broader; last segment shorter than two preceding ones together.

*Legs.* Light testaceous.

*Undersurface.* Dark testaceous.

*Male abdomen.* Aedeagus (Fig. 75): median lobe slender, ventrally slightly concave; with short apical point and elongate subapical genital opening with finely beaded margin; connecting membrane with dorsal row of about 12 single teeth; tegmen lightly sclerotized with basal piece three times as long as apical piece. Retracted segment: tergum with flatly rounded apex with about seven stiff hairs; with transverse row of fenestrae and a more proximal parallel row of slightly larger fenestrae which is shortly interrupted in the middle; sternum consisting of pair of curved sclerites ending in sharp point (Fig. 77). Spiculum gastrale (Fig. 76) with small V-shaped interspicular sclerite. Last exposed sternum with broad shallow apical indentation.

*Female abdomen.* Last exposed tergum (Fig. 78) triangular with apex divided by a slit leading into a margined groove on ventral surface.



Figs 73–78. *A.* (*A.*) *fontium* spec. nov. 73: head and prothorax. 74: elytron of male. 75: aedeagus. 76: spiculum gastrale of male. 77: sternum of retracted abdominal segment of male. 78: tergum of last exposed abdominal segment of female.

MATERIAL EXAMINED. South Africa: Pretoria, Fountains [2528CC], 15.i.1952, Holotype ♂, (A. L. Capener) (AMSA); Rustenburg, Henops River [2527DD], 27.xii.1950, Paratype ♂, (A. L. Capener) (AMSA); Pretoria [2528CA], xii.1951, Paratypes 2 ♂♂, (B. Smit) (AMSA); 26 km west of Pretoria [2528DB], 26.xii.1952, Paratypes 2 ♂♂, (C. N. Smithers) (AMSA); Pretoria, Fountains [2528CC], 9.i.1952, Paratypes 21 ♂♂, 28 ♀♀, (A. L. Capener) (AMSA); Pretoria, Irene [2528CC], 30.i.1952, Paratypes 2 ♂♂, 21 ♀♀, (A. L. Capener) (AMSA); Pretoria, Fountains [2528CC], 31.i.1961, Paratypes 9 ♂♂, 21 ♀♀, (A. L. Capener) (AMSA).

## SECTION 5

The species of this section have a pair of parallel sclerites which lie parallel to and dorsal to the median lobe of the aedeagus. The parallel sclerites are proximally attached to the connecting membrane. The species of this section occur in the four provinces of South Africa, one species in Tanzania and one in Zimbabwe.

### Key to the species of Section 5

1 Median lobe of aedeagus laterally much flattened, with ventral pointed apex ........ 2
— Median lobe of aedeagus not laterally flattened, not with ventral pointed apex ...... 4
2 Teeth of connecting membrane of aedeagus arranged in a dense toothfield near its attachment to base of median lobe, narrowing to a row of single teeth toward attachment to tegmen (Fig. 79) .................................... *multidenticulatus*
— Teeth of connecting membrane in single file .................................... 3
3 Parallel sclerites of aedeagus with a number of ventrally pointing spines on apical quarter (Fig. 84) ............................................ *bisbimaculatus*
— Parallel sclerites of aedeagus without spines (Fig. 88) .................... *montanus*

4 Tergum of retracted abdominal segment of male with fringe of dark spines (Fig. 94) .......... *ruficeps*

— Tergum of retracted abdominal segment of male without spines .......... 5

5 Tergum of last exposed abdominal segment of male with apical fringe of short spiny hairs (Fig. 98) .......... *magaliensis*

— Tergum of last exposed abdominal segment of male without apical fringe of hairs .... 6

6 Sternum of retracted abdominal segment of male consisting of a single narrow sclerite with apical indentation (Fig. 106) .......... *draconis*

— Sternum of retracted abdominal segment of male consisting of a pair of sclerites ..... 7

7 Teeth of connecting membrane of aedeagus arranged in a dense dorsal toothfield near attachment of connecting membrane to median lobe, gradually narrowing to a row of single teeth toward attachment to tegmen (Fig. 108) .......... *turneri*

— Teeth of connecting membrane of aedeagus not arranged in a dense toothfield ...... 8

8 Sternite of retracted abdominal segment of male consisting of a pair of bunches of spiny hairs (Fig. 115) .......... *robustissimus*

— Sternite of retracted abdominal segment of male otherwise .......... 9

9 Parallel sclerites of aedeagus longer than median lobe .......... 10

— Parallel sclerites of aedeagus shorter than, or as long as median lobe .......... 11

10 Elytra dark with two pairs of light maculae (Fig. 117); wings fully developed .... *vansoni*

— Elytra testaceous, without colour pattern; wings absent .......... *apterus*

11 Connecting membrane of aedeagus with about 30 small teeth, each one implanted on distal margin of a pigmented plate (Fig. 127) .......... *ranchhodi*

— Teeth of connecting membrane of aedeagus not implanted on pigmented plates ..... 12

12 Row of teeth of connecting membrane of aedeagus surrounded by dark pustules .... 13

— Row of teeth of connecting membrane of aedeagus not surrounded by dark pustules.... 14

13 Teeth of connecting membrane of aedeagus large and irregularly arranged, surrounded by a field of dark pustules (Fig. 129) .......... *pustulatus*

— Teeth of connecting membrane of aedeagus small, arranged in short dorsal row, surrounded by dark pustules of irregular shape (Fig. 131) .......... *forsythi*

14 Parallel sclerites of aedeagus shorter than half the length of median lobe .......... 15

— Parallel sclerites of aedeagus between half and full length of median lobe .......... 16

15 Parallel sclerites of aedeagus with dorsal saw-tooth edge (Fig. 137) .......... *humicola*

— Parallel sclerites of aedeagus with smooth edge (Fig. 140) .......... *quietus*

16 Parallel sclerites of aedeagus without hooks or spines .......... 17

— Parallel sclerites of aedeagus with hooks or spines .......... 18

17 Last exposed abdominal sternum of male with flat apex (Fig. 148) .......... *pondo*

— Last exposed abdominal sternum of male with sharp apical indentation (Fig. 152) .......... *marginatus*

18 Teeth of connecting membrane of aedeagus in single file (Fig. 155) ..... *rustenburgensis*

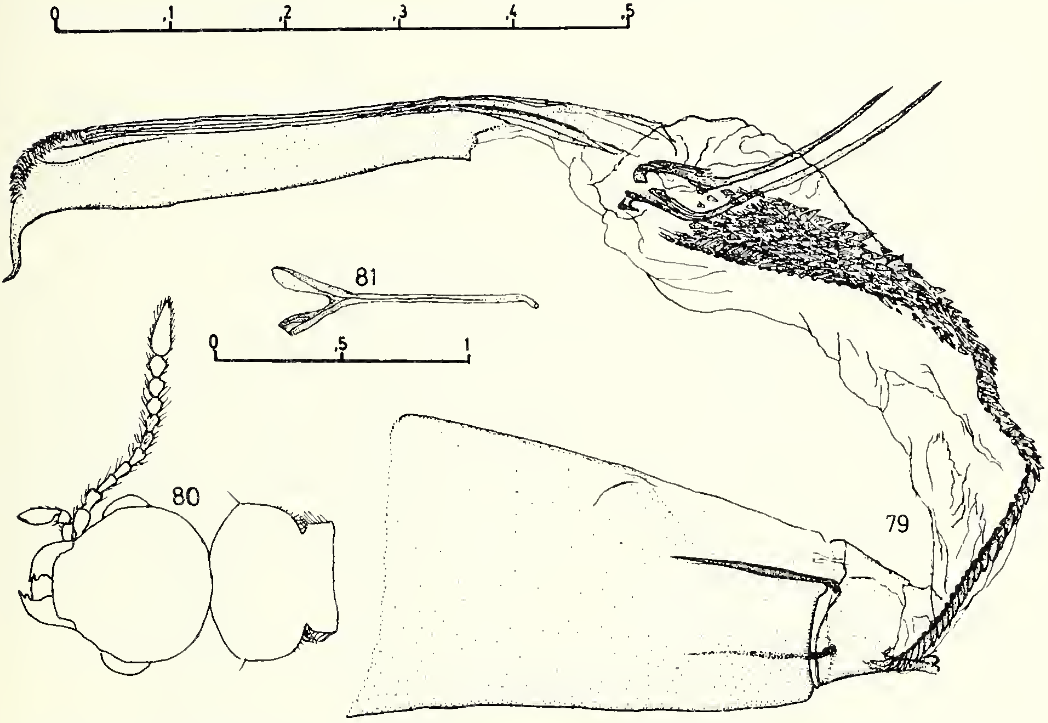
— Teeth of connecting membrane of aedeagus in transverse rows of three near attachment of connecting membrane to base of median lobe, in single file near attachment to tegmen (Fig. 164) .......... *gessi*

*Anthicus (Aulacoderus) multidenticulatus* **spec. nov.,** Figs 79–81

Size. Length 2,30 mm (2,25–2,35); width over broadest part of elytra 0,85 mm (0,83–0,88).

*Head* (Fig. 80). Somewhat glossy, black; posterior margin round; punctures fine with short dark procumbent hairs. Eyes bulging.

*Prothorax* (Fig. 80). Glossy, dark testaceous to black, basal area lighter; broader than long, narrower than head. Shoulders sloping and somewhat angular, with a pair of lateral erect



Figs 79–81. *A.* (*A.*) *multidenticulatus* spec. nov. 79: aedeagus. 80: head and prothorax. 81: spiculum gastrale of male.

hairs at greatest width. Punctures larger than on head, sparser at base, with dark recumbent hairs. Lateral constrictions at $\frac{2}{3}$ of the length of the prothorax, with fine long hairs.

*Elytra.* Somewhat glossy, black with two pairs of light maculae; punctures rather close, with dark margin and dark recumbent hairs, but with light hairs on anterior maculae forming a transverse whitish hairband, shortly interruped in the middle; dark hairs on posterior maculae.

*Wings.* Fully developed.

*Antennae* (Fig. 80). Testaceous; proximal two and apical three or four segments dark testaceous to black and broader; in some specimens the whole antenna is dark testaceous or black. Last segment longer than two preceding ones together.

*Legs.* Testaceous; coxae, femora and distal tarsal segments darker.

*Undersurface.* Dark testaceous to black.

*Male abdomen.* Aedeagus (Fig. 79): Median lobe straight, laterally broad and flat, with long genital opening with fringed margin; parallel sclerites slender and pointed, less than half the length of median lobe; connecting membrane with dorsal row of teeth occurring in single file near attachment to tegmen but toward attachment to base of median lobe forming a field of teeth; tegmen: basal piece more than three times as long as apical piece which ends in a pair of blunt dorsal lobes. Retracted segment: tergum with round apex and proximal transverse row of fenestrae lying closely applied against a more proximal transverse sclerotised line; transverse line of close dark points between fenestrae and apex; sternum consisting of a pair of thin narrow triangular plates, not reaching median line. Spiculum gastrale (Fig. 81) Y-shaped with rather broad arms. Last exposed sternum with short sharp apical indentation with two hairs on each side.

Material examined. South Africa: Grahamstown, Botanical Gardens, [3326BC], to meloid bait, 25.x.1977, Holotype ♂, Paratype ♂, (J. C. van Hille) (AMSA); same locality 26.x.1977, Partypes 3 ♂ ♂, (J. C. van Hille) (AMSA); same locality 26.x.1977, Paratypes 3 ♂ ♂, (J. C. van Hille) (AMSA); same locality ix–x.1981, Paratypes 23 ♂ ♂, (J. C. van Hille) (AMSA); Albany District [3326BC], 10.viii.1948, Paratype 1 ♂, (S. H. Kahn) (AMSA).

*Anthicus (Aulacoderus) bisbimaculatus* **spec. nov.,** Figs 82–86

Size. Length 2,48 mm (2,20–2,65); width over broadest part of elytra 0,95 mm (0,92–0,98).

*Head* (Fig. 82). Glossy, dark testaceous to black; posterior arch broadly round. Punctures fine and well spaced with dark procumbent hairs. Eyes small, somewhat bulging.

*Prothorax* (Fig. 82). Glossy, dark testaceous to black with lighter posterior area; broader than long, as broad as head; shoulders sloping, with two angles on each side and a lateral erect hair on each angle. Punctures closer than on head but reduced on posterior area. Lateral constrictions at $\frac{4}{5}$ of the length of prothorax, connected by a dorsal basal groove.

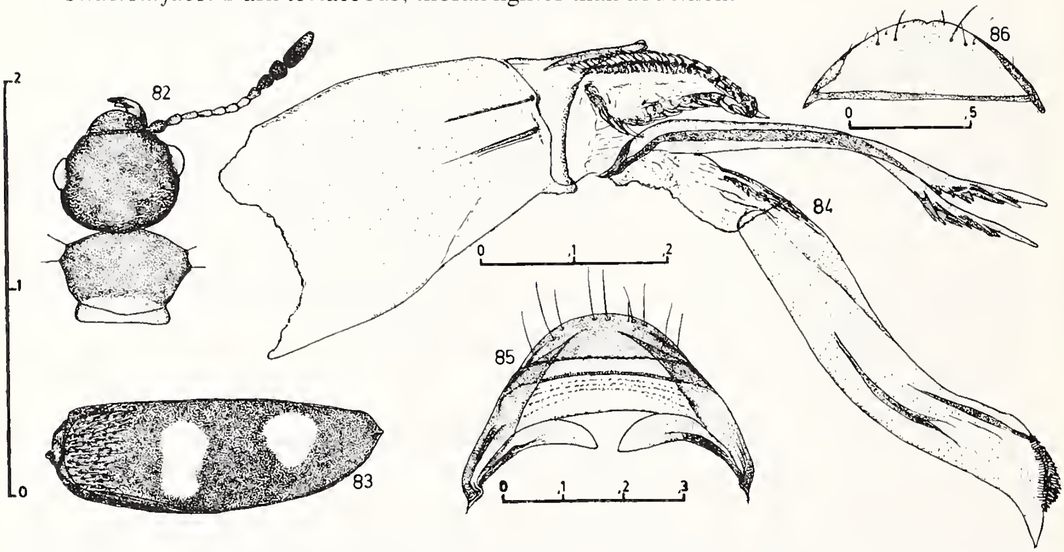
*Elytra* (Fig. 83). Glossy, black with two pairs of light maculae reaching neither median suture nor lateral margins. Punctures coarser and more widely spaced than on prothorax, with long dark hairs but with light hairs on anterior maculae; with some erect hairs, especially near lateral margins.

*Wings*. Fully developed.

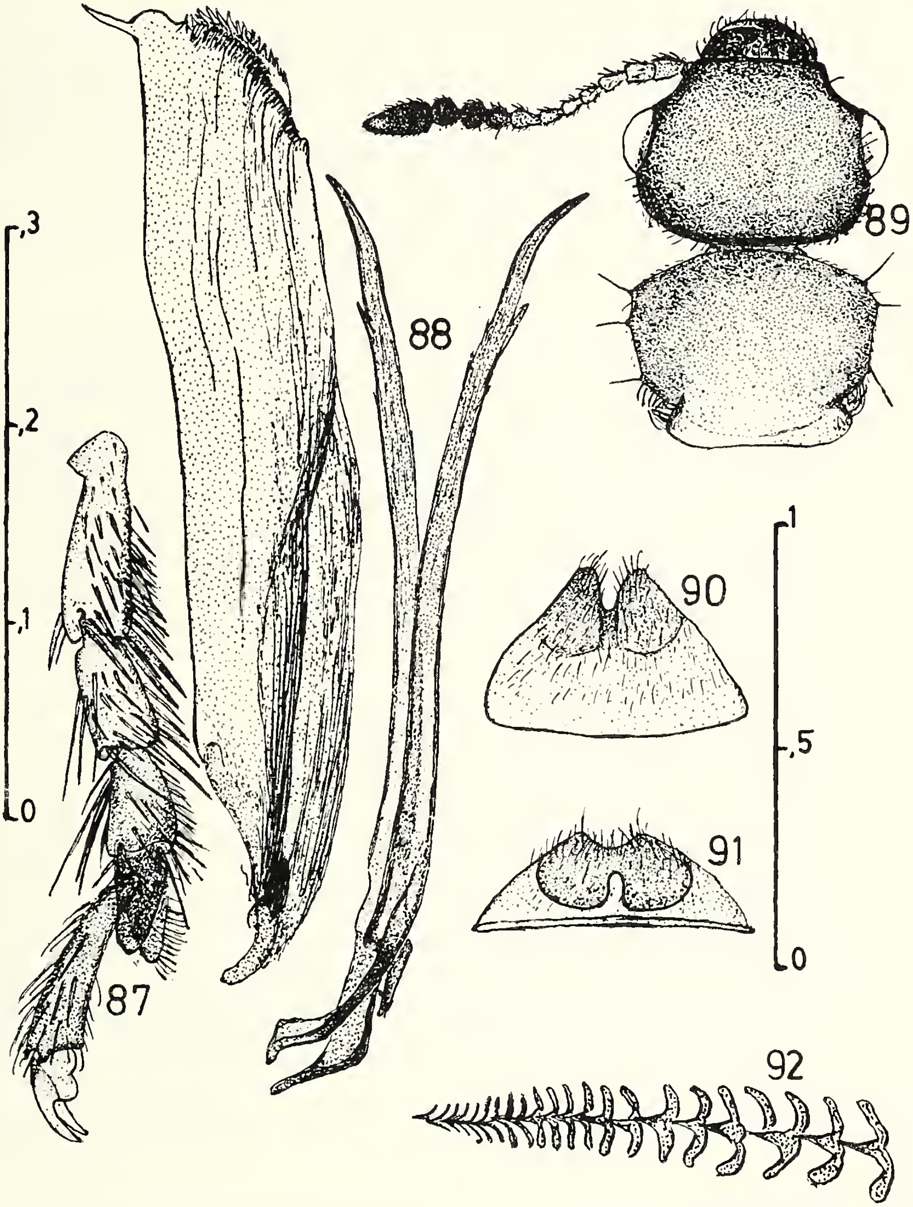
*Antennae* (Fig. 82). Testaceous to dark testaceous, apical 4–5 segments gradually darker and broader; last segment longer than two preceding ones together.

*Legs*. Testaceous; coxae and femora darker; tarsi hairy.

*Undersurface*. Dark testaceous, thorax lighter than abdomen.



Figs 82–86. *A.* (*A.*) *bisbimaculatus* spec. nov. 82: head and prothorax. 83: elytron of male. 84: aedeagus. 85: retracted abdominal segment of male. 86: last exposed abdominal sternum of male.



Figs 87–92. *A.* (*A.*) *montanus* spec. nov. 87: tarsus. 88: median lobe of aedeagus with parallel sclerites. 89: head and prothorax. 90: last exposed abdominal tergum of female. 91: last exposed abdominal sternum of male. 92: teeth of connecting membrane of aedeagus.

*Male abdomen.* Aedeagus (Fig. 84): median lobe laterally broad and flat; apex with ventral point; genital opening subapical with beaded margin surrounded by short spines; parallel sclerites with a number of apical and subapical spines facing ventrally; connecting membrane with about 32 single teeth; tegmen: basal piece three times as long as apical piece which ends in blunt dorsal points. Retracted segment (Fig. 85): tergum with two transverse dark lines, the proximal one with row of fenestrae; sternum consisting of a pair of thin curved plates, not reaching median line. Last exposed sternum (Fig. 86) apically slightly indented.

MATERIAL EXAMINED. South Africa: Drakensberg, Van Reenen [22829AD], x–xi.1926, Holotype ♂, Paratypes 3♂♂, (R. E. Turner) (BMNH); Port St Johns [3129DA], Paratype ♂, (R. E. Turner) (BMNH).

*Anthicus (Aulacoderus) montanus* **spec. nov.,** Figs 87–92

Size. Length 2,44 mm (2,13–2,93); width over broadest part of elytra 1,02 mm (0,95–1,09).

*Head* (Fig. 89). Glossy, black; posteriorly transverse with round angles to eyes. Punctures prominent with short procumbent hairs. Eyes bulging.

*Prothorax* (Fig. 89). Glossy, dark testaceous, posterior area lighter; broader than long, narrower than head; with three lateral angles on each side, each with an erect hair. Punctures as on head with short recumbent hairs, scarce on posterior area. Lateral constrictions at ¾ of length of prothorax, with long hairs.

*Elytra.* Glossy, black with two pairs of light maculae; broad, slightly convex, hardly narrowing to apex. Punctures with narrow dark margin and dark spot behind each puncture; hairs dark and recumbent but on the anterior maculae hairs are light and finer; with some erect hairs.

*Wings.* Fully developed.

*Antennae* (Fig. 89). Testaceous; proximal two and apical 3–4 segments darker and broader; last segment longer than two preceding ones together.

*Legs.* Testaceous, femora darker; distal half of tibiae and tarsi (Fig. 87) very hairy.

*Undersurface.* Dark testaceous to black.

*Male abdomen.* Aedeagus: median lobe (Fig. 88) straight, laterally broad and flat, with small ventral apical point; genital opening apical, large with finely grooved margin and small soft spines; parallel sclerites thin, as long as median lobe, appearing fibrous and even somewhat frayed over apical half; connecting membrane with about 28 single dorsal teeth; tegmen: basal piece almost three times as long as apical piece which has two blunt dorsal apical points. Retracted segment: tergum with proximal row of fenestrae and a row of dark points between apex and base: sternum consisting of a pair of narrow triangular plates, not reaching median line. Last exposed sternum slightly but sharply apically indented.

*Female abdomen.* Last exposed tergum (Fig. 90) triangular with apical indentation leading into a short ventral groove. Last exposed sternum (Fig. 91) with broad shallow indentation and with a duplicate bilobed sclerite on the dorsal surface which easily comes apart when manipulated during mounting.

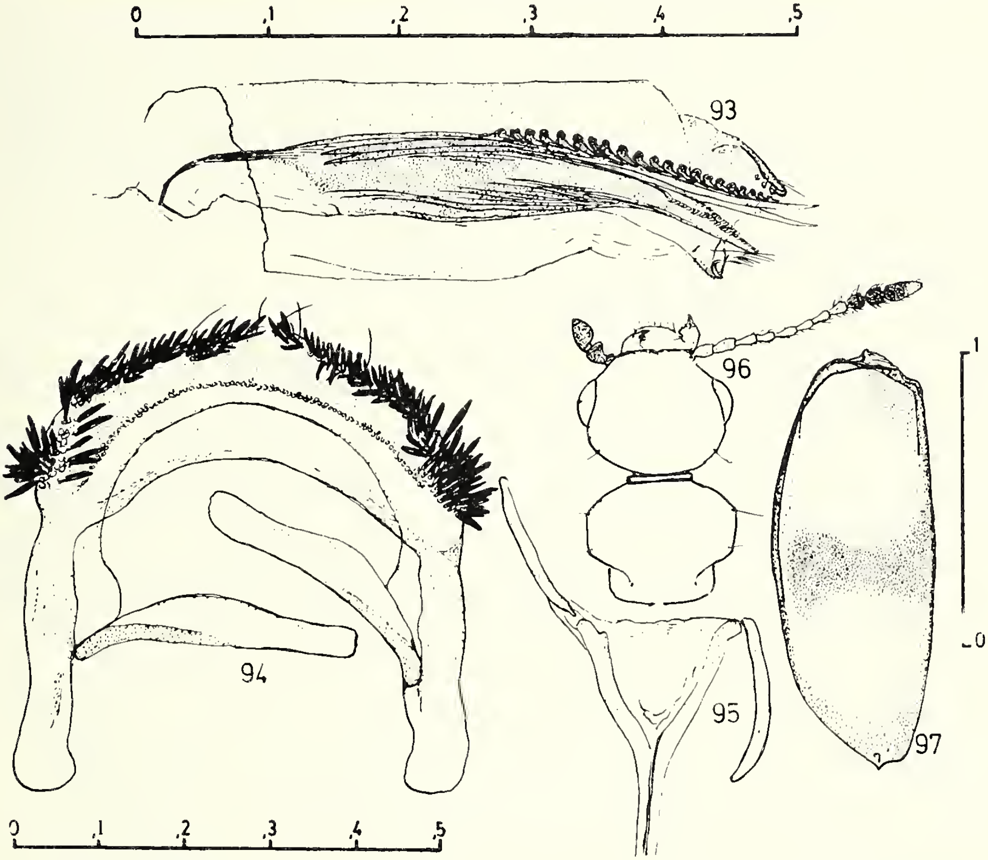
MATERIAL EXAMINED. South Africa: Hogsback [3227CA], 2.i.1952, Holotype ♂, Paratypes 7♂♂, 2♀♀. (J. C. van Hille) (AMSA).

*Anthicus (Aulacoderus) ruficeps* **spec. nov.,** Figs 93–97

Size. Length 2,25 mm; width over broadest part of elytra 0,87 mm.

*Head* (Fig. 96). Glossy, reddish testaceous; posterior arch almost straight, transverse and broad. Punctures distinct with light procumbent hairs. Eyes somewhat bulging.

*Prothorax* (Fig. 96). Reddish testaceous, lighter than head; broader than long, as broad as



Figs 93–97. *A.* (*A.*) *ruficeps* spec. nov. 93: aedeagus. 94: retracted abdominal segment of male. 95: apex of spiculum gastrale of male with extra-spicular sclerites. 96: head and prothorax. 97: elytron of male.

head; shoulders sloping and angular and with another pair of angles halfway between shoulders and base, each angle with a long and erect hair, lateral constrictions at ¾ of the length of prothorax, with long hairs which form a hairy dorsal band parallel to base but is shortly interrupted in middle. Punctures as on head with recumbent hairs but reduced at base.

*Elytra* (Fig. 97). Less reddish than head and prothorax, dark testaceous with two pairs of light maculae which extend to, and are continuous along lateral margins. Punctures more widely spaced than on prothorax, with recumbent hairs of the same colour as the area on which they are implanted.

*Wings*. Fully developed.

*Antennae* (Fig. 96). Testaceous, apical four segments darker and broader; last segment shorter than two preceding ones together.

*Maxillary palps*. Dark testaceous.

*Legs*. Testaceous.

*Undersurface*. Dark testaceous.

*Male abdomen*. Aedeagus (Fig. 93): median lobe with elongate apical genital opening with beaded margin; parallel sclerites slender and sharply pointed, as long as median lobe; connecting membrane with about 20 dark single teeth; tegmen: basal piece five times as long as apical piece which has some dorsal and ventral apical hairs. Retracted segment (Fig. 94): tergum with bluntly pointed apex and apical fringe of dark spines; row of fenestrae parallel to distal margin; sternum consisting of a pair of narrow plates. Spiculum gastrale (Fig. 95) with a pair of narrow extraspicular sclerites at apex of Y-arms. Last exposed sternum with small sharp indentation.

MATERIAL EXAMINED. South Africa: Rustenburg [2527CA], xi.1952, Holotype ♂, (A. L. Capener) (AMSA).

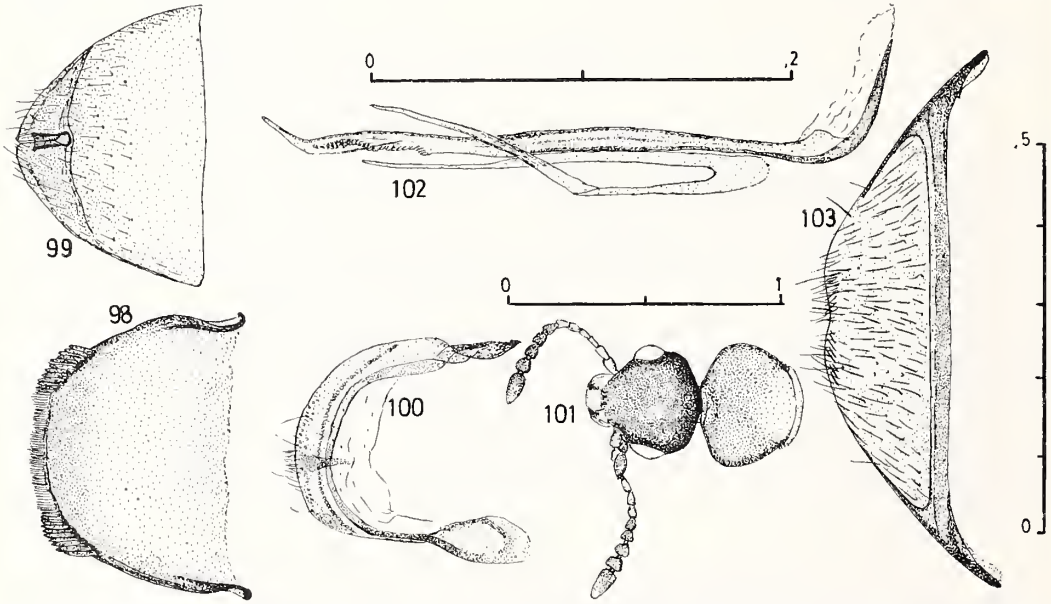
*Anthicus (Aulacoderus) magaliensis* **spec. nov.,** Figs 98–103

Size. Length 1,82 mm (1,62–2,19); width over broadest part of elytra 0,76 mm (0,65–0,89).

*Head* (Fig. 101). Glossy, dark testaceous to black, front part sligthly lighter; posterior arch broadly round. Punctures distinct with short hairs pointing transversely to median line. Eyes bulging.

*Prothorax* (Fig. 101). Somewhat glossy, dark testaceous, slightly lighter than head; posterior area lighter; broader than long, broader than head. Shoulders round. Punctures denser than on head but reduced in basal area, with short recumbent hairs. Lateral constrictions inconspicuous, without long hairs.

*Elytra*. Rather glossy, dark testaceous to black, darker than prothorax; shoulders well developed. Punctures fine, less dense than on prothorax, with fine recumbent hairs and a number of erect hairs along posterior half of lateral margins. Male with small apical point and oblique notch.



Figs 98–103. *A.* (*A.*) *magaliensis* spec. nov. 98: last exposed abdominal tergum of female. 100: tergum of retracted abdominal segment of male. 101: head and prothorax. 102: median lobe of aedeagus. 103: last exposed abdominal sternum of male.

*Wings*. Fully developed.

*Antennae* (Fig 101). Testaceous, apical 4–5 segments darker and gradually broader; last segment as long as two preceding ones together.

*Legs*. Light testaceous to testaceous; femora slightly darker.

*Undersurface*. Testaceous to dark testaceous.

*Male abdomen*. Aedeagus: median lobe (Fig. 102) short and slender with ventrally pointed apex; genital opening subapical and elongate with beaded margin; parallel sclerites thin, shorter than median lobe and fused at base; connecting membrane with about 17 single teeth; tegmen: basal piece five times as long as apical piece which ends in two blunt lobes with a few hairs. Retracted segment: tergum (Fig. 100) with dark triangular median area, transverse row of fenestrae and broad lateral bases; sternum consisting of a pair of elongate curved narrow, almost linear sclerites. Last exposed tergum (Fig. 98) with dense apical fringe of about ten spiny broad hairs on each side and thinner hairs in median area. Last exposed sternum (Fig. 103) with very slight median indentation.

*Female abdomen*. Last exposed tergum (Fig. 99) with short apical margined groove.

MATERIAL EXAMINED: South Africa: Pretoria, Zilikatsnek [2528CA], 3.x.1931, Holotype ♂, (C. Koch) (AMSA); Pretoria, Wonderboom [2528CA], Paratype ♂, (T. D. A. Cockerell) (AMSA); Pretoria, Magaliesberg [2528DC], 29.ix.1949, Paratypes 12 ♂♂, 11 ♀♀ (C. Koch) (AMSA): Nylsvlei near Nylstroom [2428CB], xii.1979, Paratypes 23 ♂♂, 16 ♀♀, (C. Eardley) (AMSA).

*Anthicus (Aulacoderus) draconis* **spec. nov.,** Figs 104–107

Size. Length 2,35 mm (2,27–2,88); width over broadest part of elytra 0,88 mm (0,82–1,05).

*Head* (Fig. 104). Glossy, black; posterior arch broad, with round angles to eyes. Punctures fine with fine grey hairs. Eyes slightly bulging.

*Prothorax* (Fig. 104). Glossy black; broader than long, broader than head; laterally somewhat angular with three pairs of erect lateral hairs. Punctures fine with fine recumbent hairs. Lateral constrictions at $\frac{4}{5}$ of length of prothorax, with long hairs which also occur on dorsal basal groove connecting lateral constrictions, only median third of groove is without hairs.

*Elytra*. Glossy, black, usually with vague indication of a lighter area in front of middle, covered with light shiny hairs. Punctures coarser than on prothorax, with recumbent hairs and a number of longer erect hairs.

*Wings*. Fully developed.

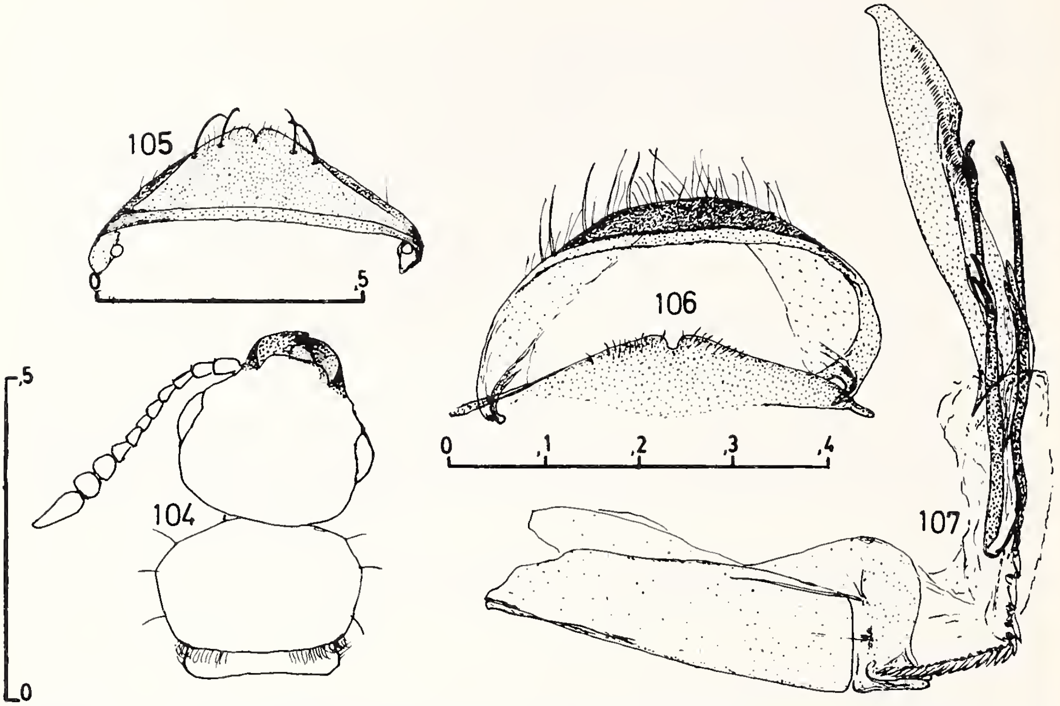
*Antennae* (Fig. 104). Rather short, dark testaceous, apical 3–4 segments darker and broader; last segment longer than two preceding ones together.

*Legs*. Testaceous to dark testaceous, femora darker.

*Undersurface*. Dark testaceous to black.

*Male abdomen*. Aedeagus (Fig. 107): median lobe laterally somewhat flat, with elongate subapical genital opening with beaded margin; parallel sclerites ending in two apical spines of unequal length and two larger spines at distal third; connecting membrane with dorsal row of about 30 single teeth; tegmen: basal piece five times as long as apical piece. Retracted segment (Fig. 106): tergum apically somewhat flat, with dark transverse line separating apical dark region from proximal light region; without row of fenestrae; sternum consisting of a single sclerite with small apical indentation. Last exposed sternum (Fig. 105) apically shortly incised with two sturdy curved hairs on each side.

MATERIAL EXAMINED. South Africa: Natal, Kloof [2930DD], viii–ix.1926, Holotype ♂, Paratype ♂, (R. E. Turner) (BMNH); Natal, Drakensberg, Van Reenen [2829AD], 3 500–6 500 ft, x.1926, Paratypes 3 ♂♂, (R. E. Turner) (BMNH).



Figs 104–107. *A.* (*A.*) *draconis* spec. nov. 104: head and prothorax. 105: last exposed abdominal sternum of male. 106: retracted abdominal segment of male. 107: aedeagus.

*Anthicus (Aulacoderus) turneri* **spec. nov.,** Figs 108–111

Size. Length 2,57 mm (2,43–2,67); width over broadest part of elytra 0,94 mm (0,87–1,00).

*Head* (Fig. 109). Glossy, black; posterior arch broadly round. Punctures fine with procumbent hairs. Eyes bulging.

*Prothorax* (Fig. 109). Glossy, black; broader than long, broader than head. Shoulders round. Punctures fine with recumbent hairs and four pairs of longer erect hairs on lateral margins. Lateral constrictions shallow, with fine long hairs.

*Elytra*. Glossy, black with a pair of orange-testaceous maculae on posterior half, reaching neither lateral margins nor median suture; shoulders well developed. Punctures somewhat coarse with recumbent hairs, longer than on prothorax; a few erect hairs.

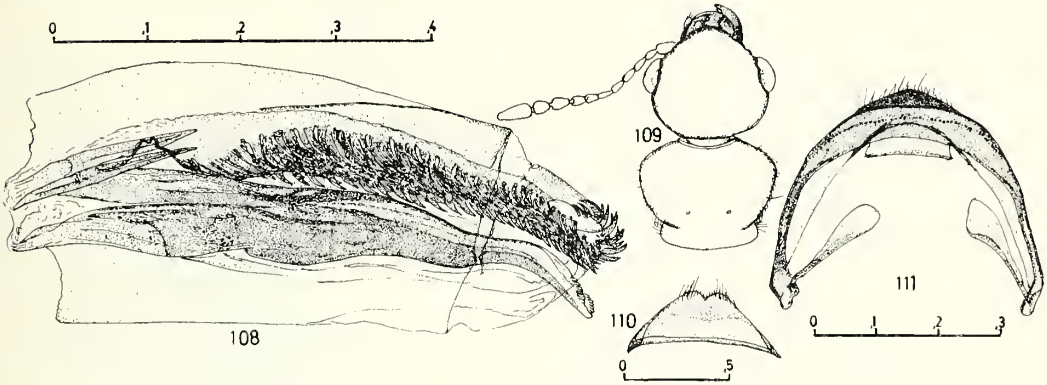
*Wings*. Fully developed.

*Antennae* (Fig. 109). Dark testaceous to black; apical 3–4 segments gradually broader; last segment slightly shorter than two preceding ones together.

*Legs*. Dark testaceous to black, tibiae and tarsi lighter.

*Undersurface*. Dark testaceous to black.

*Male abdomen*. Aedeagus (Fig. 108): median lobe with apical genital opening with beaded margin; parallel sclerites apically pointed, about $\frac{1}{3}$ of length of median lobe; connecting membrane with about 35 transverse rows of 1–7 teeth, numbers decreasing from proximal to distal



Figs 108–111. *A.* (*A.*) *turneri* spec. nov. 108: aedeagus. 109: head and prothorax. 110: last exposed abdominal sternum of male. 111: retracted abdominal segment of male.

end; tegmen: basal piece about four times as long as apical piece. Retracted segment (Fig. 111): tergum with bluntly pointed apex; apical area dark, subapical area lighter with transverse row of fenestrae and proximally pointing lip; sternum consists of a pair of short narrow plates. Last exposed sternum (Fig. 110) with sharp apical indentation.

Material examined. South Africa: Orange Free State, Harrismith [2829AC], ii-iii.1927, Holotype ♂, Paratypes 9 ♀♀, (R. E. Turner) (BMNH); Witzieshoek [2829DB], 22.ii.1929, Paratype ♂, (Hugh Scott) (BMNH); Willem Pretorius Game Reserve [2827AC], 28.iv.1979, Paratype ♂, (J. C. van Hille) (AMSA).

*Anthicus (Aulacoderus) robustissimus* Pic, Figs 112–115

*Anthicus (Aulacoderus) robustissimus* Pic, 1913c: 12

*Size.* Length 1,88 mm (1,72–2,02); width over broadest part of elytra 0,75 mm (0,72–0,80).

*Head.* Glossy, dark testaceous to black; posterior arch broadly transverse, narrowing to eyes. Punctures close with fine procumbent hairs. Eyes slightly bulging.

*Prothorax.* Glossy, dark testaceous slightly lighter than head; broader than long, broader than head. Punctures close with fine recumbent hairs. Lateral constrictions close to posterior margin, with long hairs.

*Elytra.* Glossy, dark testaceous; broad with round shoulders. Punctures more widely spaced than on prothorax, hairs longer.

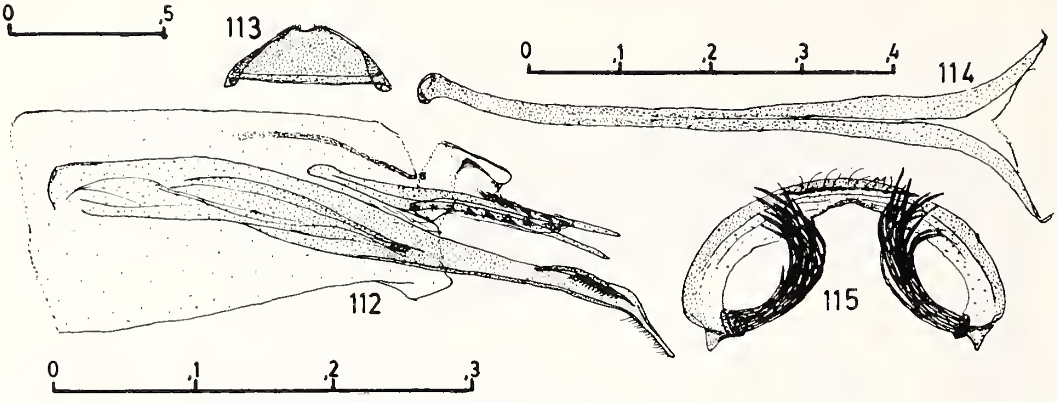
*Wings.* Fully developed.

*Antennae.* Testaceous, last three segments darker and broader; last segment as long as two preceding ones together.

*Legs.* Dark testaceous, tibiae and tarsi lighter.

*Undersurface.* Very dark testaceous, thorax somewhat lighter; mesepimerite apophyses rather long, apical half light, without spiral markings.

*Male abdomen.* Aedeagus (Fig. 112): median lobe with hairy apical spine and dorsal subapical spine pointing proximally, lying at left of elongate genital opening which has a beaded margin; parallel sclerites short; connecting membrane with about 15 teeth in single file; tegmen little sclerotised, basal piece five times as long as apical piece. Retracted segment (Fig. 115): tergum broad with hairy apex; sternum consisting of two bunches of about 15 dark spines each.



Figs 112–115. *A.* (A.) *robustissimus* Pic. 112: aedeagus. 113: last exposed abdominal sternum of male. 114: spiculum gastrale of male. 115: retracted abdominal segment of male.

Spiculum gastrale (Fig. 114) Y-shaped with broad apex. Last exposed sternum (Fig. 113) slightly indented at apex.

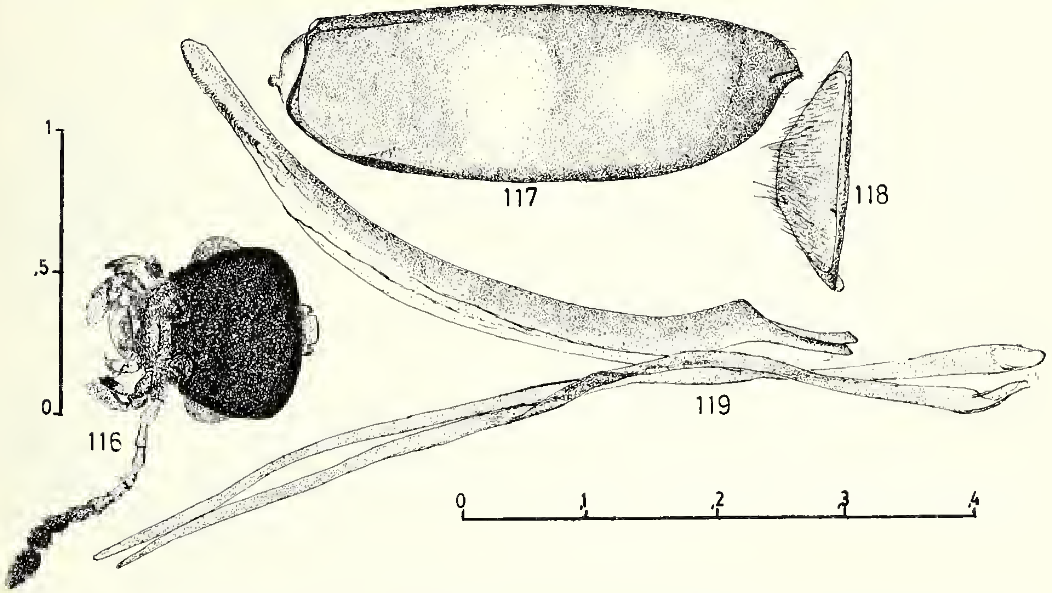
MATERIAL EXAMINED. Rhodesia (now Zimbabwe): Salisbury (now Harare), no date, Type ♀, Pic det., (no collector) (NMW); near Fort Victoria, ix.1931, 1 ♂, det. Heberdey, (Miss A. Mackie) (NMW).

In addition to these specimens the author found in material, on loan from the museum in Vienna, two more specimens named. *A. (A.) robustissimus* Pic: 1) from South Africa, P. Bonae Spei, Zulus (*sic*), coll. Fry, 1 ♂, Pic det. This specimen is *A.* (*A.*) *bicoloritarsis* Pic (1948), described from South Africa, Plettenberg Bay [3423AB]. This is a coastal species occurring along the whole South African coast line. 2) South Africa, Wonderboom [2528CA], x.1931, coll. T. D. A. Cockerell: 1 ♂, det. Heberdey. This specimen is *A.* (*A.*) *magaliensis* spec. nov., described from Pretoria.

These two misidentifications may cast doubt on the correctness of the identification of the first two specimens. The author has considered the following points: 1) The ♀ specimen was collected at the type locality and was named by Pic, the author. It was collected some time before the date of description which makes it probable that it was indeed part of the type material. The ♂ specimen was collected about 270 km south of the type locality. It is bigger than than the ♀ type (2,02 mm against 1,75 mm) but its size agrees better with 2 mm as given by Pic in the description. The two specimens agree well in features not influenced by sex difference, like shape of head and prothorax, colour and distribution of punctures and hairs.

Pic (1948) described two variations of *A.* (*A.*) *robustissimus*, var. *convexipennis* and var. *pallidior*, from the coast of the eastern Cape Province, South Africa. The material was collected by the author. Both variations are *A.* (*A.*) *rotundipennis* Pic (1895a). This species is variable in colour and has a strictly coastal distribution, whereas *A.* (*A.*) *robustissimus* is an inland species.

In the same paper (Pic, 1948) a new species is described: *A.* (*A.*) *subrotundipennis* Pic which is said to resemble *A.* (*A.*) *robustissimus* var. *pallidior* Pic. The material was collected by the author along the coast of the eastern Cape Province and is also *A.* (*A.*) *rotundipennis* Pic (1985a). It is indeed difficult to identify these species on external features only.



Figs 116–119. *A.* (*A.*) *vansoni* spec. nov. 116: head 117: elytron of male. 118: last exposed abdominal sternum of male. 119: median lobe of aedeagus with parallel sclerites.

*Anthicus (Aulacoderus) vansoni* **spec. nov.,** Figs 116–119

Size. Length 3,0 mm (2,50–3,20); width over broadest part of elytra 1,14 mm (1,00–1,28).

*Head* (Fig. 116). Somewhat glossy, black; posterior arch broadly transverse, converging to eyes. Punctures fine with short light procumbent hairs. Eyes bulging.

*Prothorax.* Somewhat glossy, black. Shoulders round. Broader than long, as broad as head. Punctures fine with fine recumbent hairs. Lateral constrictions inconspicuous with short light hairs. With two pairs of erect lateral hairs, anterior pair on shoulders, posterior pair halfway between shoulders and base.

*Elytra* (Fig. 117). Somewhat glossy, black with two pairs of light maculae, anterior pair reaching lateral margins but not median suture, posterior pair smaller and round. Hairs close and recumbent, those on anterior maculae finer and lighter; with a number of short erect hairs, especially along lateral margins and on posterior quarter.

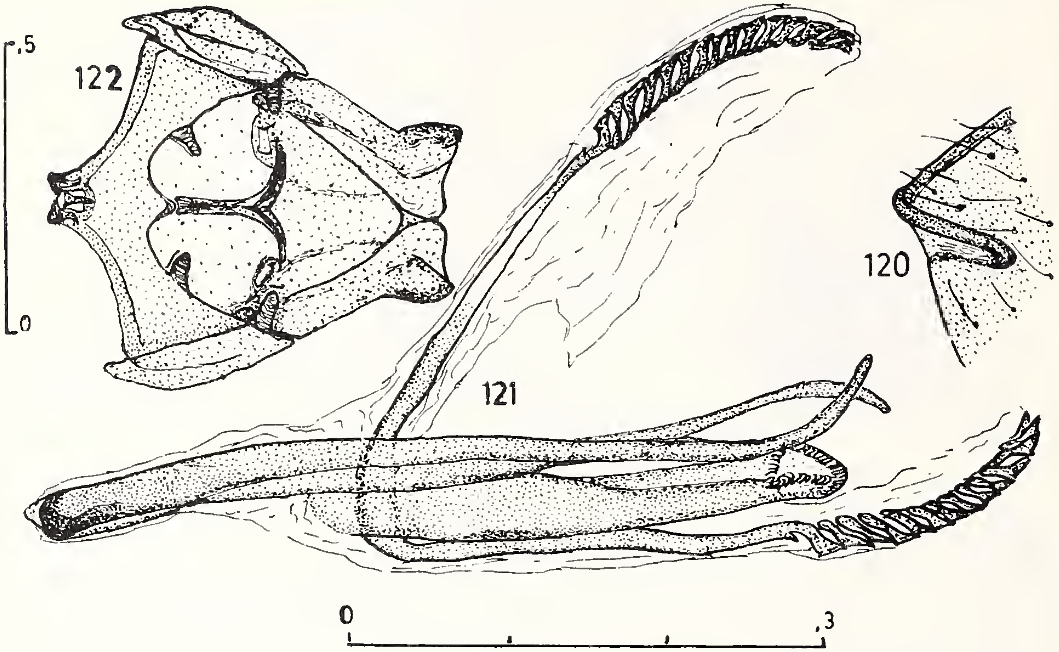
*Wings.* Fully developed.

*Antennae* (Fig. 116). Dark testaceous, 3–4 apical segments broader; last segment as long as two preceding ones together.

*Legs.* Dark testaceous, femora almost black.

*Undersurface.* Dark testaceous to black.

*Male abdomen.* Aedeagus: median lobe (Fig. 119) dorsally convex, simple in shape with elongate genital opening with beaded margin; parallel sclerites longer than median lobe; connecting membrane with about 17 teeth of which the apical three are single, the others with small lateral sclerotisations which do not form denticles; tegmen: basal piece longer than apical piece which ends in a pair of blunt points. Retracted segment: tergum semi-circular, apical region hairy and very dark with transverse dark line; proximal region lighter with transverse row of fenestrae in the middle; sternum consisting of a pair of small plates with some apical hairs. Last exposed sternum (Fig. 118) with flat apex.



Figs 120–122. *A.* (*A.*) *apterus* van Hille. 120: apex of elytron of male. 121: median lobe of aedeagus with connecting membrane and parallel sclerites. 122: meso- and metathoracic sterna.

Material examined. South Africa: Pretoria North [2528CA], 3.ix.1932, Holotype ♂, (G. van Son) (AMSA); Rustenburg [2527CA], 3.xii.1953, Paratypes 2 ♂♂, (A. L. Capener) (AMSA).

*Anthicus (Aulacoderus) apterus* van Hille, Figs 120–122

*Anthicus (Aulacoderus) apterus* van Hille, 1961: 243

Size. Length 2,55 mm (2,50–2,60); width over broadest part of elytra 0,68 mm (0,63–0,73).

*Head.* Glossy, dark testaceous to black; posterior arch broadly oval, almost round. Punctures fine with fine procumbent hairs. Eyes small, not bulging.

*Prothorax.* Glossy, testaceous; longer than broad, narrower than head. Shoulders sloping and round. Punctures very fine with short recumbent hairs. Lateral constrictions shallow, with few long hairs.

*Elytra.* Glossy, testaceous; convex, without shoulders. Punctures fine with short recumbent hairs. In male with small apical point and well developed notch with thick lateral margin (Fig. 120).

*Wings.* Absent; metatergum much reduced in both sexes.

*Antennae.* Testaceous, apical five segments gradually slightly darker and slightly broader; last segment shorter than two preceding ones together.

*Legs.* Testaceous.

*Undersurface.* Testaceous; in addition to the mesepimerite apophyses a similar pair of apophyses on front margin of metasternum, pointing forwards and lying dorsal to mesocoxal cavities (Fig. 122); metepisternum immovably fused onto metasternum, a feature not seen in other species of Aulacoderus.

*Male abdomen.* Aedeagus (Fig. 121): median lobe short with short triangular genital opening with beaded margin; parallel sclerites more than 1½ times as long as median lobe; connecting membrane with two dorsal rows of about 12–14 teeth each; tegmen: basal piece longer than apical piece. Spiculum gastrale with asymmetrical Y-arms, one shorter than other. Retracted segment: tergum with flat apex and transverse row of fenestrae near base; sternum consisting of pair of thin elongate plates with narrow base and broad apex with row of hairs. Last exposed sternum with round apex.

MATERIAL EXAMINED. South Africa: Kirstenbosch [3318CD], 29.x.1950. Holotype ♂, Paratype ♀, (Brink and Rudebeck) (UEML); Cape Point Nature Reserve [3418AD], 24.x.1950 and 10.xii.1950, Paratypes 2 ♀♀, (Brink and Rudebeck) (UEML); Houtbay, Schoorsteen Kop [3418AB], 9.xii.1950, Paratype ♀, (Brink and Rudebeck) (UELM); Newlands Cape, Rhodes Drive [3318CD], to meloid bait, 19.xi.1979, 2 ♂♂, (J. C. van Hille) (AMSA); Newlands Cape, Forest Reserve [3318CD], to meloid bait, 21.xi.1979, 1 ♂, (J. C. van Hille) (AMSA); Cape Point Nature Reserve, Buffels Bay [3418AD], to meloid bait, 23.xi.1979, 2 ♂♂, (J. C. var Hille) (AMSA).

*Anthicus (Aulacoderus) ranchhodi* **spec. nov.**, Figs 123–127

Size. Length 2,75 mm; width over broadest part of elytra 0,75 mm.

*Head* (Fig. 124). Glossy, black; posterior arch broad, outline of head narrowing by an almost straight line to mouthparts. Punctures distinct with dark procumbent hairs. Eyes bulging.

*Prothorax* (Fig. 124). Glossy, black; broader than long, broader than head; shoulders sloping to lateral angular points; with three pairs of erect lateral hairs: 1st pair between neck and shoulder angle, 2nd pair on shoulder angle, 3rd pair between shoulder and lateral constriction. Punctures as on head, with dark recumbent hairs. Lateral constrictions at $\frac{5}{7}$ of length of prothorax, with fine long hairs.

*Elytra* (Fig. 123). Elongate, glossy, black, with a pair of transverse light maculae in middle, extending more forwards than backwards, reaching neither lateral margins nor median suture. Punctures distinct with dark recumbent hairs but on maculae the hairs are light and point obliquely to lateral margin over greater part of surface.

*Wings.* Fully developed.

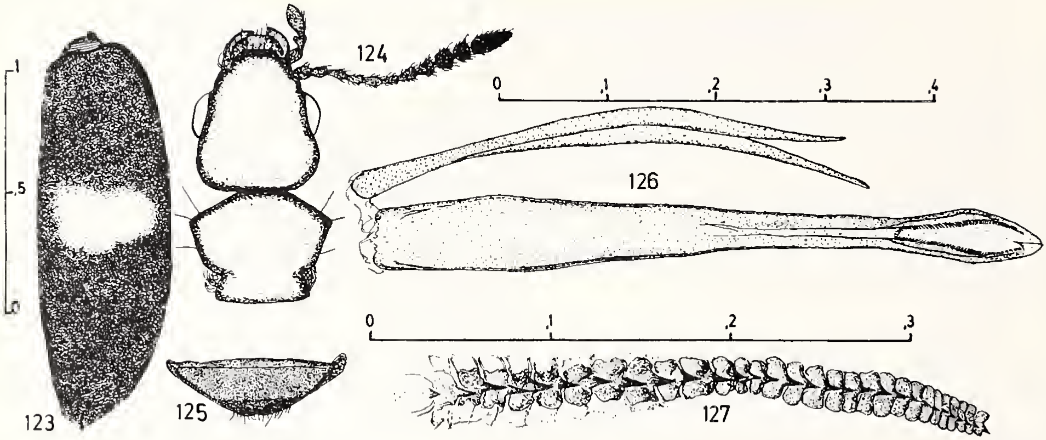
*Antennae* (Fig. 124). Dark testaceous to black; apical 3–4 segments broader; last segment slightly longer than two preceding ones together.

*Legs.* Dark testaceous; coxae and femora black.

*Undersurface.* Black.

*Male abdomen.* Aedeagus: median lobe (Fig. 126) slender, with elongate apical genital opening with finely grooved margin; parallel sclerites slender and pointed, shorter than median lobe; connecting membrane (Fig. 127) with dorsal row of about 30 small teeth, each standing on a separate pigmented plate; tegmen with basal piece about three times as long as apical piece. Retracted segment: tergum with dark hairy apical part and subapical dark transverse line and basal dark transverse line; in between a row of fenestrae which is single in middle but multiple at sides; sternum consisting of elongate pigmented sclerites, each with two spiny hairs. Last exposed sternum (Fig. 125) with small apical indentation.

MATERIAL EXAMINED. South Africa: Mogoto [2429AC], to meloid bait, 24.x.1979, Holotype ♂, (M. W. Mansell) (AMSA).



Figs 123–127. *A.* (*A.*) *ranchhodi* spec. nov. 123: elytron of male. 124: head and prothorax. 125: last exposed abdominal sternum of male. 126: median lobe of aedeagus with parallel sclerites. 127: row of teeth of connecting membrane of aedeagus.

*Anthicus (Aulacoderus) pustulatus* **spec. nov.,** Figs 128–130

Size. Length 2,30 mm; width over broadest part of elytra 0,90 mm.

*Head.* Glossy, dark testaceous to black; posterior arch broad and transverse, rounded to eyes. Punctures close with fine short procumbent hairs.

*Prothorax.* Glossy, dark testaceous; broader than long. broader than head. Punctures as on head with short recumbent hairs and three pairs of long erect lateral hairs. Lateral constrictions at $\frac{6}{7}$ of length of prothorax with fine long hairs.

*Elytra.* Glossy, dark testaceous; rather short and broad. Punctures more widely spaced than on prothorax, with fine recumbent hairs and some erect hairs, hardly longer than recumbent hairs.

*Wings.* Fully developed.

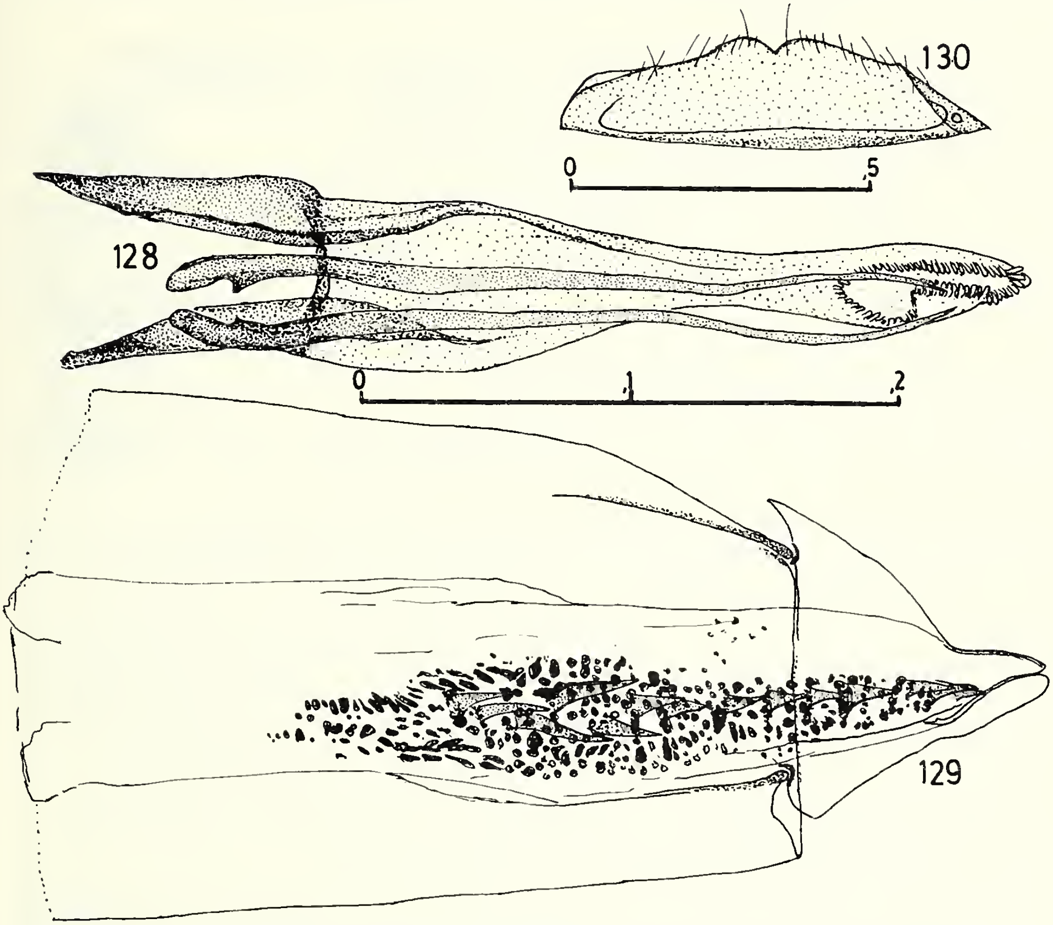
*Antennae.* Dark testaceous; apical four segments broader; last segment shorter than two preceding ones together.

*Legs.* Testaceous.

*Undersurface.* Testaceous, abdomen darker than thorax.

*Male abdomen.* Aedeagus: median lobe (Fig. 128) slender, with large apical genital opening with beaded margin; parallel sclerites slender and pointed, not much shorter than median lobe; connecting membrane (Fig. 129) with about 14 large pointed dorsal teeth, not strictly arranged in a longitudinal row and surrounded by an elaborate array of dark pustules; tegmen: basal piece three times as long as apical piece which ends in a pair of blunt lobes. Retracted segment: tergum semi-circular with proximal row of fenestrae; sternum consisting of pair of narrow short plates. Last exposed sternum (Fig. 130) short and broad with short sharp apical indentation.

MATERIAL EXAMINED. South Africa: Estcourt, Kimbolton [2929BB], 23.x.1892, Holotype ♂, (G. A. K. Marshall) (BMNH).



Figs 128–130. *A.* (*A.*) *pustulatus* spec. nov. 128: median lobe of aedeagus with parallel sclerites. 129: tegmen and connecting membrane of aedeagus with teeth and pustules. 130: last exposed abdominal sternum of male.

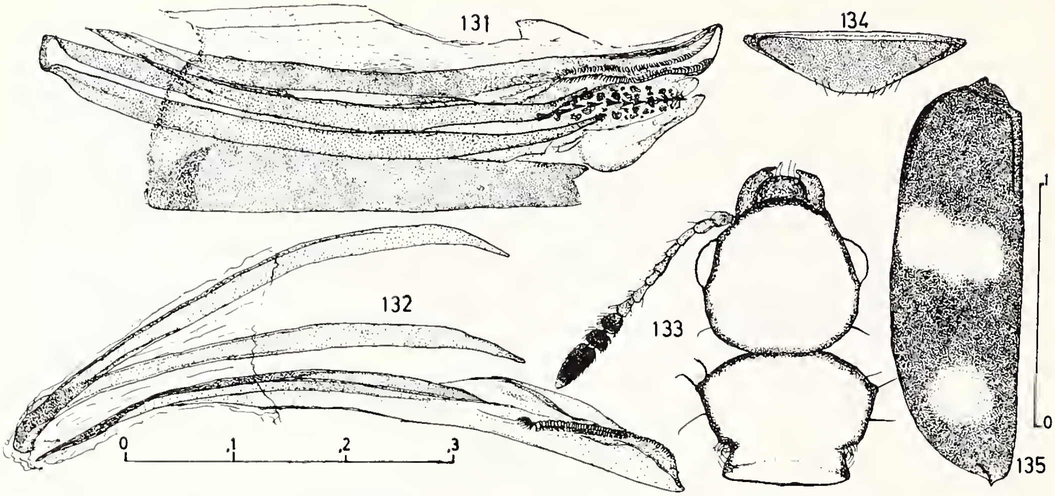
*Anthicus (Aulacoderus) forsythi* **spec. nov.**, Figs 131–135

Size. Length 2,56 mm (2,42–2,72); width over broadest part of elytra 0,91 mm (0,75–0,98).

*Head* (Fig. 133). Glossy, black; posterior arch very broad with pair of lateral erect hairs half-way between eyes and neck. Punctures fine and close with procumbent hairs. Eyes bulging.

*Prothorax* (Fig. 133). Glossy, black; broader than long, as broad as head. Shoulders sloping and angular; with three pairs of long erect lateral hairs. Punctures close with short recumbent hairs. Lateral constrictions at $\frac{2}{3}$ of length of prothorax, with long fine whitish hairs; a transverse dorsal shallow depression connects the lateral constrictions.

*Elytra* (Fig. 135). Elongate, glossy, black with two pairs of testaceous maculae: anterior



Figs 131–135. *A.* (*A.*) *forsythi* spec. nov. 131: aedeagus. 132: median lobe of aedeagus with parallel sclerites. 133: head and prothorax. 134: last exposed abdominal sternum of male. 135: elytron of male.

pair in front of middle, somewhat rectangular, not reaching median suture; posterior pair subapical and roughly round. Punctures distinct with dark recumbent hairs, but on anterior maculae hairs are silvery and on median half of macula hairs are not recumbent but point outwards and backwards with an angle of 45° with longitudinal axis; with a number of semi-erect hairs implanted in transparent punctures. In male with small apical point and oblique notch.

*Wings*. Fully developed.

*Antennae* (Fig. 133). Testaceous to dark testaceous, apical 3–5 segments darker, apical 3–4 segments broader; last segment longer than two preceding ones together.

*Legs*. Testaceous; coxae and femora dark testaceous to black.

*Undersurface*. Black.

*Male abdomen*. Aedeagus (Fig. 131): median lobe (Fig. 132) slender with elongate genital opening with distinctly grooved margin; parallel sclerites pointed, shorter than median lobe; connecting membrane with dorsal row of about 12 dark small pointed teeth, surrounded by dark pustules of irregular shape; tegmen: basal piece three times as long as apical piece. Retracted segment: tergum broad with two transverse dark lines, one subapical, the other at base; between these lines are many fenestrae arranged in a somewhat irregular double row; sternum consisting of a pair of dark elongate sclerites with strongly sclerotised proximal margin and each with two spiny hairs. Last exposed sternum (Fig. 134) with flat apex without indentation.

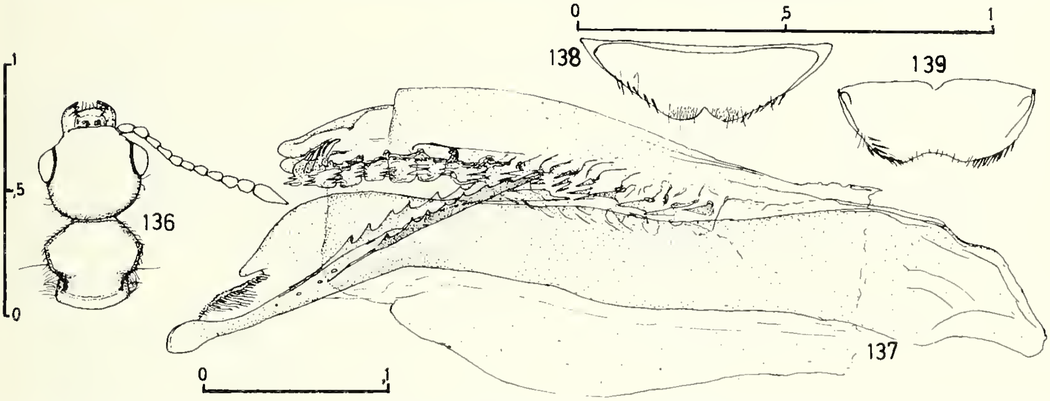
MATERIAL EXAMINED. South Africa: Mogoto [2429AC], to meloid bait, 24.x.1979, Holotype ♂, Paratypes 6 ♂♂, (M. W. Mansell) (AMSA).

*Anthicus (Aulacoderus) humicola* **spec. nov.,** Figs 136–139

Size. Length 2 mm; width over broadest part of elytra 0,85 mm.

*Head* (Fig. 136). Glossy, testaceous; posterior arch broadly round. Punctures distinct with procumbent hairs. Eyes with dark margin, bulging.

*Prothorax* (Fig. 136). Glossy, testaceous; broader than long, narrower than head. Shoul-



Figs 136–139. *A.* (*A.*) *humicola* spec. nov. 136: head and prothorax. 137: aedeagus. 138: last exposed abdominal sternum of male. 139: last exposed abdominal tergum of male.

ders sloping and angular and with a pair of obtuse lateral angles shortly anterior to lateral constrictions which are at $\frac{2}{3}$ of length of prothorax, with long hairs and connected by a fine transverse dorsal groove.

*Elytra.* Glossy, testaceous; shoulders round; rather short, broadest at anterior third. Punctures fine with recumbent hairs, longer than on prothorax.

*Wings.* Fully developed.

*Antennae* (Fig. 136) Light testaceous, apical segments slightly broader but not darker; last segment slightly longer than two preceding ones together.

*Legs.* Light testaceous.

*Undersurface.* Testaceous, abdomen slightly darker than thorax.

*Male abdomen.* Aedeagus (Fig. 137): median lobe with blunt apex, subapical genital opening with beaded margin and broad blunt dorsal spine immediately proximal to genital opening; parallel sclerites narrow with dorsal saw-like edge with 6–7 teeth; connecting membrane with dorsal rows of about 20 teeth of which the middle ones occur in transverse rows of three; tegmen lightly sclerotized with basal piece four times as long as apical piece which ends in two blunt lobes. Retracted segment: tergum with narrow dark apical area with central group of hairs diverging backwards and outwards; with broad transverse dark line and row of fenestrae in lighter proximal area; sternum consisting of a pair of narrow, almost linear, sclerites. Last exposed tergum (Fig. 139) with short shallow apical indentation and about 10 short spine-like hairs on each side. Last exposed sternum (Fig. 138) with sharp apical indentation with about 6 spiny marginal hairs on each side.

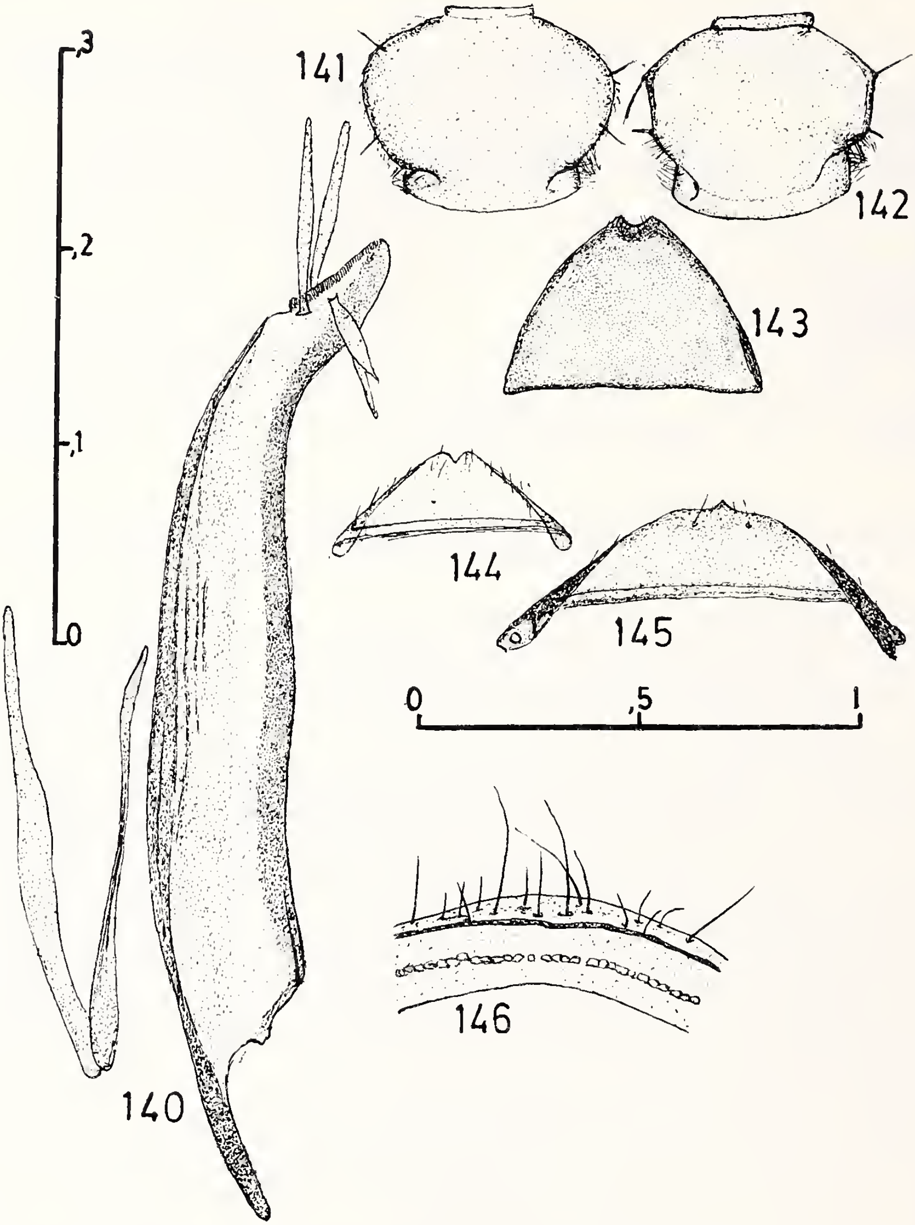
Material examined. Congo (now Zaire): Kivu, Terr. Fizi, Itomwe nord 900 m, recolté dans l'humus iv.1951, Holotype ♂, (N. Leleup) (MRAC).

The attachment of the saw-edge sclerites to the connecting membrane is not visible; the author has assumed that these structures are homologous with parallel sclerites.

*Anthicus (Aulacoderus) quietus* **spec. nov.**, Figs 140–146

Size. Length males 1,88 mm (1,72–2,03), females 2,25 mm (2,13–2,34); width over broadest part of elytra males 0,68 mm (0,66–0,70), females, 0,99 mm (0,96–1,00).

*Head.* Glossy, dark testaceous in male, in female somewhat lighter; posterior arch broadly



Figs 140–146. *A.* (*A.*) *quietus* spec. nov. 140: median lobe of aedeagus with parallel sclerites. 141: prothorax of male. 142: prothorax of female. 143: last exposed abdominal tergum of female. 144: last exposed abdominal sternum of male. 145: last exposed abdominal sternum of female. 146: detail of tergum of retracted segment of male.

round. Hairs short and procumbent and a few erect hairs on posterior lateral margin. Eyes slightly bulging.

*Prothorax*. Glossy, testaceous, lighter than head; broader than long, broader than head; in male with round shoulders (Fig. 141), in female with two pairs of lateral angles, each angle with an erect hair (Fig. 142); male has erect hairs in corresponding positions. Punctures close with recumbent hairs but scarce on posterior area, especially in female. Lateral constrictions deep with long hairs, connected by basal transverse dorsal depression.

*Elytra*. Glossy, testaceous with dark transverse band behind middle; median basal corner and apical area also slightly darker. Punctures more widely spaced than on prothorax, with recumbent hairs; on the lighter parts of the elytra the hairs are finer, lighter and shorter than on dark parts.

*Wings*. Fully developed.

*Antennae*. Testaceous, apical 3–4 segments darker and broader; last segment shorter than two preceding ones together.

*Legs*. Light testaceous.

*Undersurface*. Testaceous with sparse fine recumbent hairs.

*Male abdomen*. Aedeagus: median lobe (Fig. 140) short and broad, with two pairs of spines around genital opening which has a beaded margin; parallel sclerites slender and simple, less than half the length of median lobe; connecting membrane with about 22 single teeth; tegmen: basal piece five and a half times as long as apical piece which ends in two round points. Retracted segment: tergum lightly sclerotised and hardly pigmented but with dark transverse line and more proximal transverse row of fenestrae (Fig. 146); sternum consisting of a pair of thin slender plates. Last exposed sternum (Fig. 144) with short apical indentation.

*Female abdomen*. Last exposed tergum (Fig. 143) with short round apical indentation. Last exposed sternum (Fig. 145) with small apical point.

MATERIAL EXAMINED. South Africa: Rustenburg [2527CA], 4–7.xii.1951, Holotype ♂, Paratypes 1 ♂, 3 ♀ ♀, (A. L. Capener) (AMSA); Nylsvlei near Nylstroom [2428CB], to light, xii.1979, Paratype ♂, (C. Eardley) (AMSA).

*Anthicus (Aulacoderus) pondo* **spec. nov.,** Figs 147–150.

Size. Length 2,93 mm; width over broadest part of elytra 1,13 mm.

*Head*. (Fig. 150). Somewhat glossy, black, posterior arch broad. Punctures fine, rather close, with black procumbent hairs. Eyes somewhat bulging.

*Prothorax* (Fig. 150). Somewhat glossy, black, lighter at base; broader than long, as broad as head. Shoulders sloping and angular and with another pair of lateral angles in front of lateral constrictions. Punctures close with short black recumbent hairs but posterior area less closely punctured and with longer hairs. Lateral constrictions deep, at $\frac{3}{4}$ of length of prothorax, with fine long hairs.

*Elytra* (Fig. 149). Glossy, dark testaceous to black with two pairs of light maculae, anterior pair small and indistinct, posterior pair distinct and round, touching lateral margin. Punctures close with coarse black hairs but on maculae the hairs are finer and lighter.

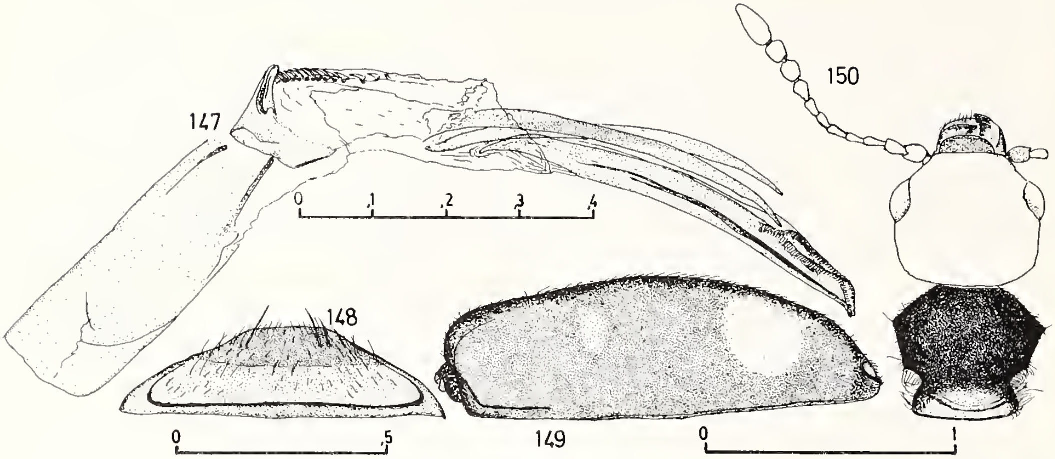
*Wings*. Fully developed.

*Antennae* (Fig. 150). Dark testaceous; first proximal and apical three segments darker and broader; apical segment as long as two preceding ones together.

*Legs*. Dark testaceous to black.

*Undersurface*. Dark testaceous.

*Male abdomen*. Aedeagus (Fig. 147): median lobe slender with large apical genital opening with beaded margin; parallel sclerites simple and pointed, shorter than median lobe; connecting membrane with about 13 single teeth; tegmen: basal piece three and a half times as long as apical piece. Retracted segment: tergum semi-circular with transverse dark line and



Figs 147–150. *A.* (*A.*) *pondo* spec. nov. 147: aedeagus. 148: last exposed abdominal sternum of male. 149: elytron of male. 150: head and prothorax.

parallel row of fenestrae; sternum consisting of a pair of slender triangular plates. Last exposed sternum (Fig. 148) apically flat with a few long hairs on each side.

Material examined. South Africa: Pondoland, Port St Johns [3128DA], 3–15.iv.1924, Holotype ♂, (R. E. Turner) (BMNH).

*Anthicus (Aulacoderus) marginatus* **spec. nov.**, Figs 151–154.

Size. Length 2,60 mm; width over broadest part of elytra 0,95 mm.

*Head.* Glossy, black; posterior arch broad with round angles, slightly diverging to eyes. Punctures rather fine with dark procumbent hairs. Eyes rather small and bulging.

*Prothorax.* Glossy, dark testaceous to black; broader than long, broader than head. Shoulders round. Lateral constrictions at $\frac{6}{7}$ of length of prothorax. Punctures finer and more widely spaced than on head, with dark recumbent hairs.

*Elytra* (Fig. 153). Somewhat glossy, light testaceous with dark margin varying in breadth, making central light area narrower behind middle. Punctures fine with recumbent hairs which are dark on dark margin and also on a transverse band where central light area is narrowest; on the rest of central light area the hairs are colourless.

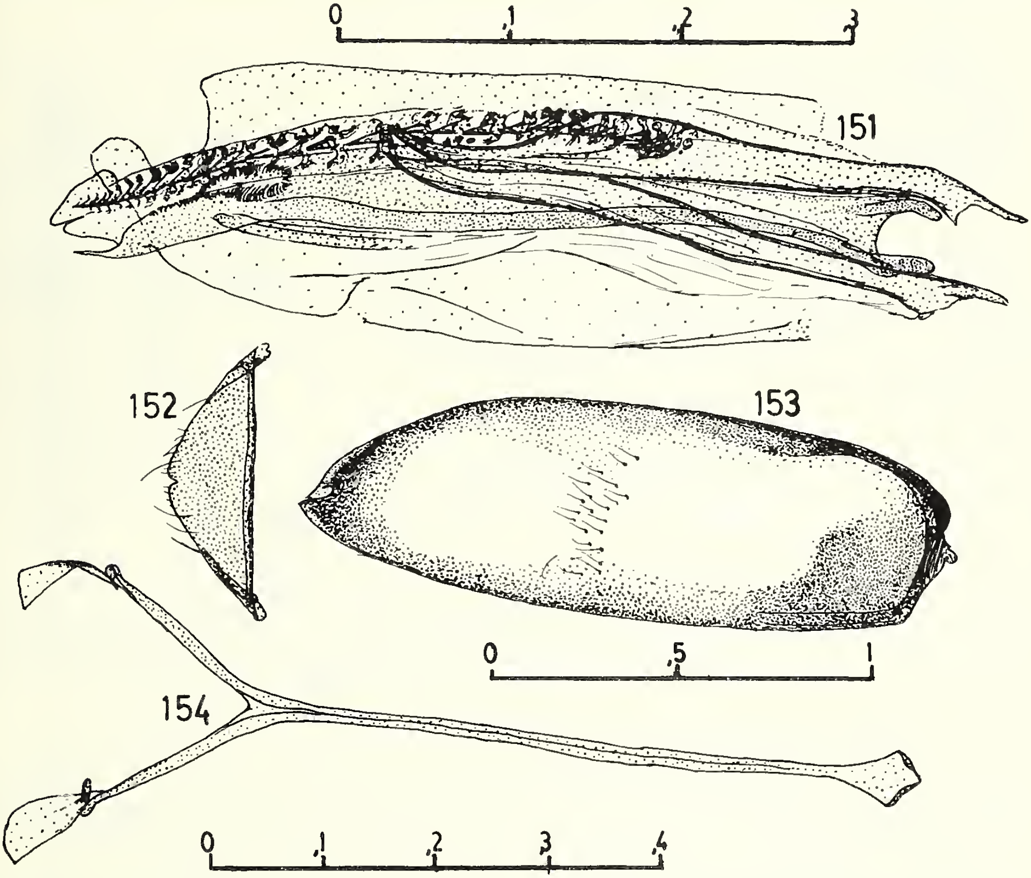
*Wings.* Fully developed.

*Antennae.* Testaceous with proximal first and apical four segments darker and broader; last segment as long as two preceding ones together.

*Legs.* Testaceous, coxae and femora much darker, almost black.

*Undersurface.* Thorax testaceous to dark testaceous; abdomen dark testaceous to black.

*Male abdomen.* Aedeagus (Fig. 151): median lobe slender with small apical point and wide subapical genital opening; parallel sclerites apically pointed, about $\frac{3}{4}$ of length of median lobe; connecting membrane with about 28 teeth; tegmen little sclerotised, basal piece twice as long as apical piece which has two blunt apical points. Retracted segment: tergum with flat apex, dark apical area with transverse dark line and parallel more proximal row of fenestrae; sternum consisting of a pair of short narrow sclerites. Spiculum gastrale (Fig. 154) Y-shaped with pair of small apical extra-spicular sclerites. Last exposed sternum with small sharp indentation (Fig. 152).



Figs 151–154. *A.* (*A.*) *marginatus* spec. nov. 151: aedeagus. 152: last exposed abdominal sternum of male. 153: elytron of male. 154: spiculum gastrale with extraspicular sclerites of male.

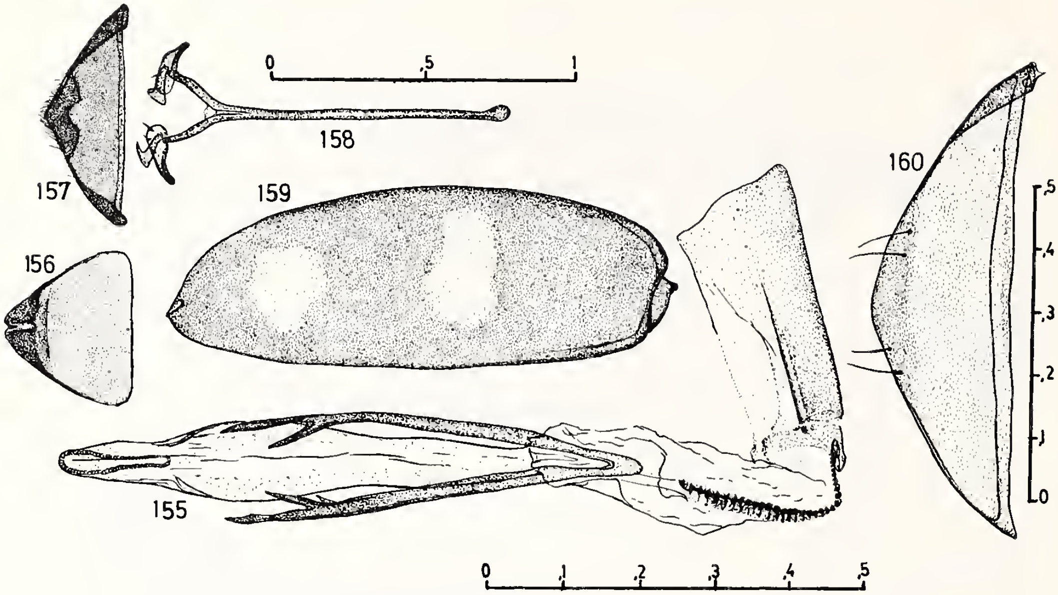
Material examined. South Africa: Pretoria, Fountains [2528CC], 20.ii.1952, Holotype ♂, (A. L. Capener) (AMSA); Pretoria [2528CA], light trap, 18.ii.1957, Paratype ♂, (Entomologist) (AMSA).

*Anthicus (Aulacoderus) rustenburgensis* **spec. nov.,** Figs 155–160

Size. Length 2,74 mm (2,44–3,16); width over broadest part of elytra 1,13 mm (0,94–1,20).

*Head.* Glossy, black; posterior arch almost straight and transverse, with round angles to eyes. Punctures dense with short procumbent hairs. Eyes somewhat bulging.

*Prothorax.* Somewhat glossy, black but lighter at posterior margin; broader than long, broader than head. Shoulders sloping and angular. Lateral constrictions at $\frac{3}{4}$ of length of prothorax, with long hairs. Punctures dense with short recumbent hairs.



Figs 155–160. *A.* (*A.*) *rustenburgensis* spec. nov. 155: aedeagus. 156: last exposed abdominal tergum of female. 157: last exposed abdominal sternum of female. 158: spiculum gastrale with extra-spicular sclerites and sternum of retracted abdominal segment of male. 159: elytron of male. 160: last exposed abdominal sternum of male.

*Elytra.* (Fig. 159). Glossy, black with two pairs of light maculae. Punctures with dark recumbent hairs but on anterior maculae hairs are finer lighter and shorter; some erect hairs along lateral margins and on posterior region.

*Wings.* Fully developed.

*Antennae.* Testaceous, proximal first and apical 3–4 segments darker and broader; last segment longer than two preceding ones together.

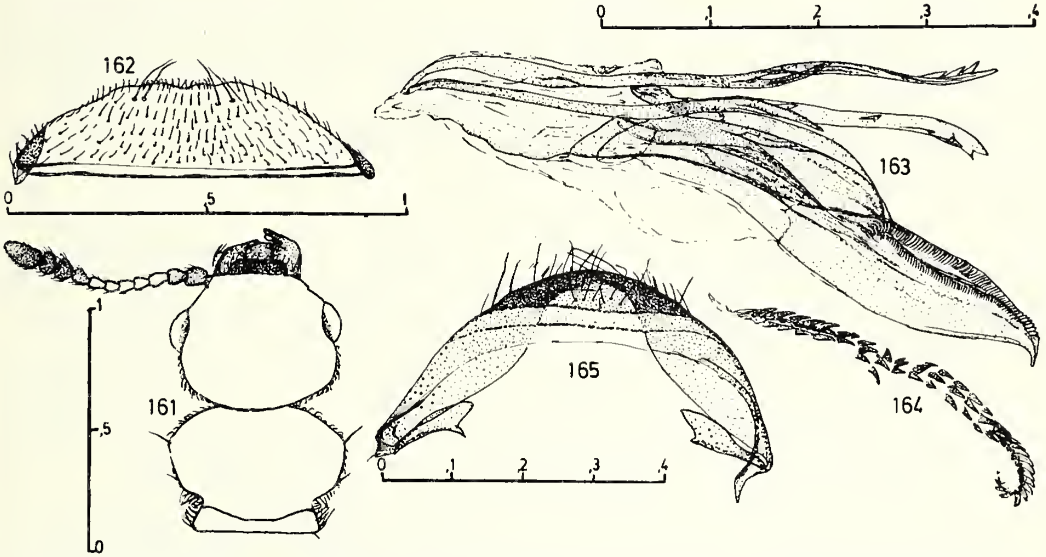
*Legs.* Testaceous, coxae and femora darker.

*Undersurface.* Dark testaceous to black.

*Male abdomen.* Aedeagus (Fig. 155): Median lobe with apical elongate genital opening; parallel sclerites fused at base, with two or three apical points each; connecting membrane with about 32 single teeth; tegmen: basal piece five times as long as apical piece. Retracted segment: tergum with dark apical part with darker basal line and more proximal row of fenestrae; sternum consisting of a pair of narrow sclerites, each with two apical hairs (Fig. 158). Spiculum gastrale (Fig. 158) with small curved extra-spicular sclerite at end of each Y-arm. Last exposed sternum (Fig. 160) with bluntly pointed apex.

*Female abdomen.* Last exposed tergum (Fig. 156) with apical indentation and short median groove. Last exposed sternum (Fig. 157) with apical margin folded inwards, apically pointed.

Material examined. South Africa: Rustenburg [2527CA], xi.1952, Holotype ♂, Paratypes 14 ♀♀, (A. L. Capener) (AMSA).



Figs. 161–165. *A.* (*A.*) *gessi* spec. nov. 161: head and prothorax. 162: last exposed abdominal sternum of male. 163: median lobe and parallel sclerites of aedeagus. 164: dorsal row of teeth of connecting membrane of aedeagus. 165: retracted abdominal segment of male.

*Anthicus (Aulacoderus) gessi* **spec. nov.**, Figs 161–165

Size. Length 2,69 mm (2,57–2,82); width over broadest part of elytra 1,03 mm (0,97–1,10).

*Head* (Fig. 161). Glossy, black; posterior arch broadly round with short hairs. Punctures rather dense with short grey procumbent hairs. Eyes rather small, only slightly bulging.

*Prothorax* (Fig. 161). Glossy, black; broader than long, slightly broader than head. Shoulders somewhat angular, each with an erect lateral hair. Punctures as on head with short recumbent hairs. Lateral constrictions at $\frac{4}{5}$ of length of prothorax, connected by transverse dorsal groove with long hairs. Basal area testaceous with fine light procumbent hairs.

*Elytra.* Somewhat glossy, black with pair of testaceous maculae in middle, extending further backwards than forwards. Punctures rather close with fine grey recumbent hairs, longer than on prothorax; with a few semi-erect hairs on shoulder area.

*Wings.* Fully developed.

*Antennae* (Fig. 161). Dark testaceous, rather short; apical 3–4 segments broader and slightly darker; last segment slightly longer than two preceding ones together.

*Legs.* Testaceous, femora and last tarsal segment darker.

*Undersurface.* Dark testaceous to black.

*Male abdomen.* Aedeagus: median lobe (Fig. 163) laterally flattened with elongate apical genital opening with beaded margin; parallel sclerites slender, shorter than median lobe, each with about four short hooks and a long forked hook between $\frac{1}{2}$ and $\frac{1}{3}$ of the length of the parallel sclerite; connecting membrane with row of about 30 teeth (Fig. 164) which occur in transverse rows of three near attachment to base of median lobe but in single file near attachment to tegmen; tegmen: basal piece about five times as long as apical piece which ends in two blunt points. Retracted segment (Fig. 165): tergum rather broad, apically dark, with transverse line and more proximal transverse row of fenestrae; sternum consisting of pair of short sclerites. Last exposed sternum (Fig. 162) with apical margin slightly undulated in median area and with two long hairs on each side.

MATERIAL EXAMINED. South Africa: Natal, Drakensberg, Van Reenen 5 500–6 500 m [2829AD], x–xi.1926, Holotype ♂, Paratypes 4 ♂♂, (R. E. Turner) (BMNH).

## SECTION 6

The species of this section, in contrast with those of sections 7 and 8, have no ventral spine on the apical region of the median lobe of the aedeagus. The species of this section are distributed over the whole of Africa and only one species has a strictly coastal distribution.

### Key to the species of Section 6

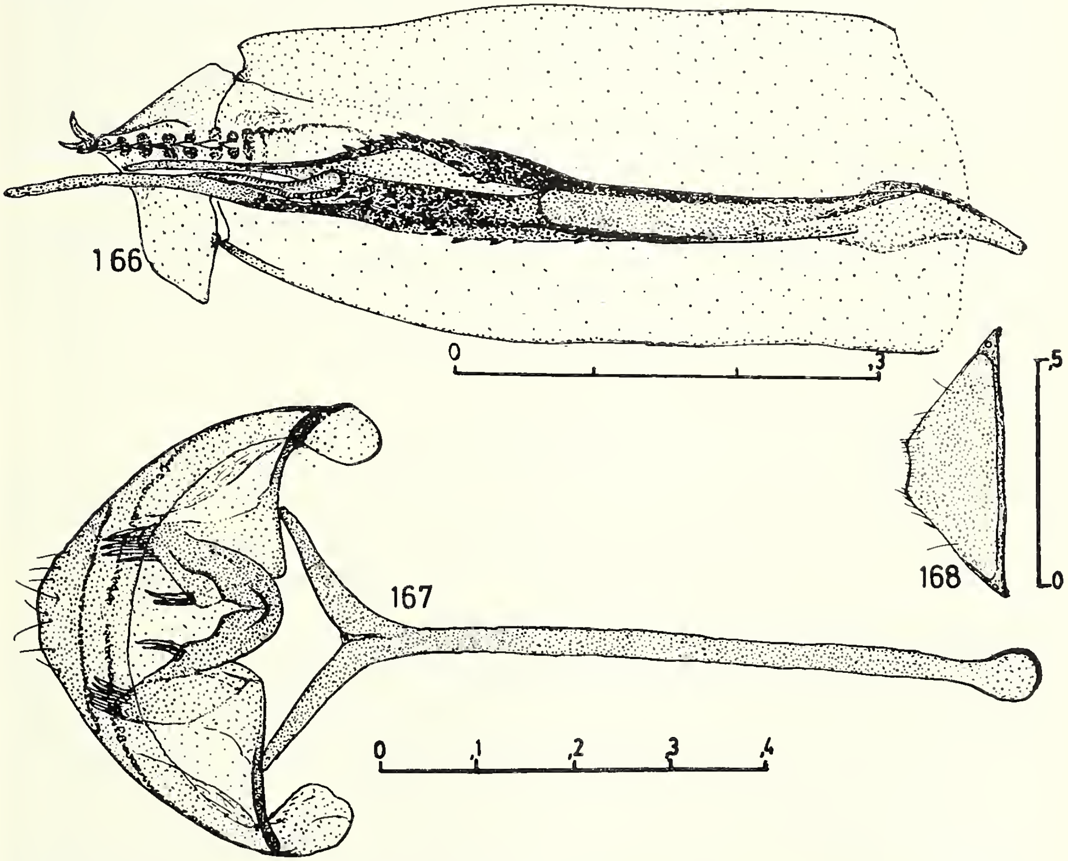
| | | |
|---|---|---|
| 1 | Sternum of retracted abdominal segment of male consisting of a single complicated structure with two sets of spines on each side (Fig. 167) | *perfuscus* |
| — | Sternum of retracted abdominal segment of male consisting of paired structures | 2 |
| 2 | Male genital opening about as long as half the length of median lobe of aedeagus | 3 |
| — | Male genital opening shorter than half the length of median lobe of aedeagus | 4 |
| 3 | Male genital opening with more than 20 spines on each side (Fig. 170) | *mutatus* |
| — | Male genital opening not surrounded by spines (Fig. 174); tergum of retracted segment of male with two patches of dark hairs (Fig. 173) | *bedfordi* |
| 4 | Elytra of male with dark apical spine | 5 |
| — | Elytra of male without dark apical spine | 6 |
| 5 | Apical elytral spine of male small and blunt (Fig. 178) | *munroi* |
| — | Apical elytral spine of male large and pointed and opposed by an elytral lobe with a number of spiny hairs (Fig. 184) | *convexus* |
| 6 | Sternum of retracted abdominal segment of male with a bundle of black inwards pointing bars (Fig. 191) | *mediofasciatus* |
| — | Sternum of retracted abdominal segment of male without black bars | 7 |
| 7 | Connecting membrane of aedeagus with two rows of seven teeth each; median lobe of aedeagus ending in a pair of points, otherwise not sclerotised (Fig. 197) | *schimperi* |
| — | Connecting membrane of aedeagus with one row of teeth although teeth may occur in transverse rows of 3–5 | 8 |
| 8 | Elytra black with a pair of light maculae on posterior half (Fig. 200); median lobe of aedeagus very slender and long (Fig. 198); connecting membrane with about 35 teeth | *morani* |
| — | Elytra not black with a pair of posterior maculae | 9 |
| 9 | Teeth of connecting membrane of aedeagus in single file; elytra light testaceous to testaceous with or without dark markings | 10 |
| — | Teeth of connecting membrane of aedeagus in transverse rows of 3–5 | 13 |
| 10 | Sternite of retracted segment of male with apical spines | 11 |
| — | Sternite of retracted segment of male without apical spines | 12 |
| 11 | Median lobe of aedeagus with long spine distal to genital opening and a parallel dorsal spine attached proximally to genital opening, almost as long (Fig. 202) | *chicarubiensis* |
| — | Median lobe of aedeagus very slender with long spine, distal to genital opening and a very short dorsal spine attached proximally to genital opening (Fig. 207) | *stephani* |
| 12 | Connecting membrane of aedeagus with about 11 teeth (Fig. 213) | *nemoralis* |
| — | Connecting membrane of aedeagus with about 28 teeth (Fig. 214) | *minimus* |

13 Elytra light testaceous or testaceous with dark transverse bands; genital opening without beaded margin (Fig. 219) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . *simoni*
— Elytra dark testaceous, without pattern . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 14
14 Median lobe of aedeagus short and broad (Fig. 223); teeth of connecting membrane short and broad . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . *inopinans*
— Median lobe of aedeagus long and slender; teeth of connecting membrane small and thin (Fig. 229) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . *termitophilus*

*Anthicus (Aulacoderus) perfuscus* **spec. nov.**, Figs 166–168

Size. Length 2,23 mm (2,00–2,40); width over broadest part of elytra 0,83 mm (0,80–0,91).

*Head.* Glossy, dark testaceous to black; posterior arch broadly round. Punctures well spaced, with fine procumbent hairs; about six erect hairs on dorsal surface and a pair of lateral erect hairs between eyes and neck. Eyes bulging.



Figs 166–168. *A.* (*A.*) *perfuscus* spec. nov. 166: median lobe of aedeagus. 167: retracted abdominal segment and spiculum gastrale of male. 168: last exposed abdominal sternum of male.

*Prothorax.* Glossy, testaceous, slightly lighter than head, with lighter base; broader than long, slightly broader than head. Shoulders sloping and angular, with an erect lateral hair on each angle. Punctures closer than on head but absent on posterior area; hairs fine and recumbent. Lateral constrictions not prominent, with some longish hairs.

*Elytra.* Glossy, testaceous, lighter than prothorax; elongate with fine punctures and recumbent hairs and with about 36 erect or semi-erect hairs more than twice as long as the recumbent hairs, distributed over the whole surface.

*Wings.* Fully developed.

*Antennae.* Light testaceous, apical three segments darker and somewhat broader; last segment longer than two preceding ones together.

*Maxillary palps.* Darker than base of antennae.

*Legs.* Light testaceous, coxae and femora darker.

*Undersurface.* Testaceous, abdomen darker than thorax.

*Male abdomen.* Aedeagus (Fig. 166): median lobe with long apical point distal to genital opening and dorsal process facing genital opening; promixal to genital opening the lateral margins of median lobe have each a longitudinal row of about 12 short sharp distally pointing spines; connecting membrane with dorsal row of about 9 teeth each with a dark footplate resembling those of *A.* (*A.*) *ranchhodi* (Fig. 127); tegmen: apical piece dorsally pointed, basal piece five times as long as apical piece. Retracted segment (Fig. 167): tergum with transverse row of fenestrae, shortly interrupted in the middle and dark transverse line distal to row of fenestrae; sternum consisting of a single sclerite with two sets of spines on each side. Spiculum gastrale with short widely diverging Y-arms. Last exposed sternum (Fig. 168) with apical indentation.

MATERIAL EXAMINED. South Africa: Natal, Oqalweni (? = Oqaqeni [2931AA]), in humus, x.1960, Holotype ♂, Paratypes 3 ♂♂, (N. Leleup) (TMP); Natal, Bergville District, Induneni Forest, in humus, [2929AA], x.1960, Paratype 1 ♂, (N. Leleup) (TMP); Van Reenen [2829AD], xi.1926, Paratype ♂, (R. E. Turner) (BMNH).

The structure of the sternum of the retracted segment of male is unique.

*Anthicus (Aulacoderus) mutatus* Gemm., Figs 169–172

*Anthicus (Aulacoderus) mutatus* Gemminger, 1870: 123

*Anthicus (Aulacoderus) transversalis* La Ferté, 1848: 270

Size. Length 2,19 mm (1,74–2,52); width over broadest part of elytra 0,81 mm (0,66–0,90).

*Head* (Fig. 169). Somewhat glossy, testaceous to dark testaceous; posterior arch round. Punctures fine with fine whitish procumbent hairs and a pair of semi-erect lateral hairs between eyes and neck. Eyes bulging.

*Prothorax* (Fig. 169). Somewhat glossy, testaceous, often lighter than head; longer than broad, narrower than head. Shoulders round. Punctures fine with whitish hairs somewhat coarser than on head; a pair of lateral erect hairs on shoulders and a similar pair half-way between shoulders and lateral constrictions. Lateral constrictions at ¾ of length of prothorax.

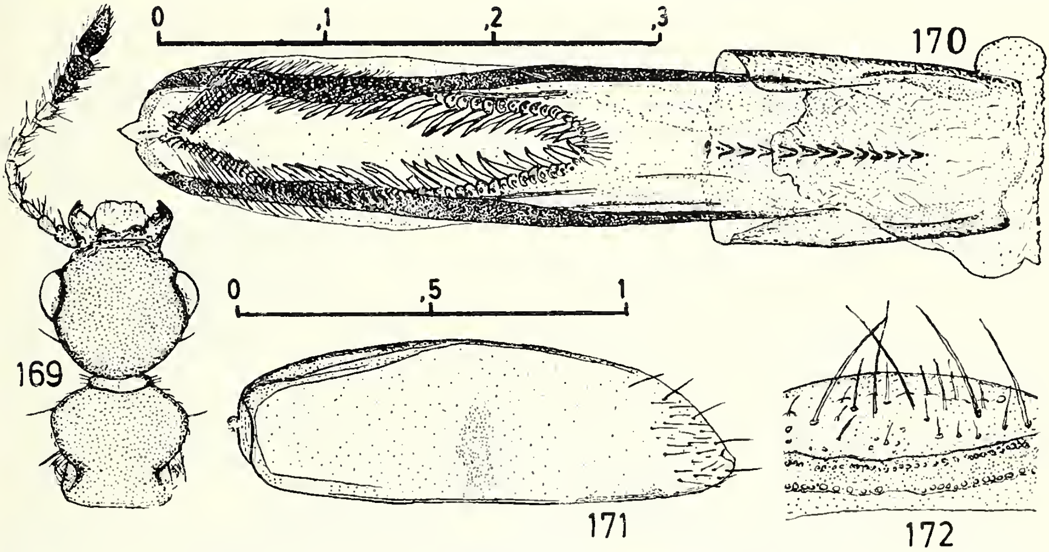
*Elytra* (Fig. 171). Slightly glossy, testaceous with transverse dark band in middle which usually does not reach lateral margins; a darker narrow elongate area at ¾ of length of elytra; with fine whitish recumbent hairs and a number of erect longer hairs.

*Wings.* Fully developed.

*Antennae* (Fig. 169). Testaceous, three apical segments broader and darker, almost black.

*Legs.* Testaceous.

*Undersurface.* Testaceous.



Figs 169–172. *A.* (*A.*) *mutatus* Gemm. 169: head and prothorax. 170: aedeagus. 171: elytron of male. 172: detail of tergum of retracted segment of male.

*Male abdomen*. Aedeagus: median lobe (Fig. 170) with large genital opening with beaded margin and surrounded by two rows of spines which become thinner toward apex; connecting membrane with dorsal row of about 12 small teeth; tegmen lightly sclerotized, basal piece longer than apical piece. Retracted segment: tergum (Fig. 172) with double row of fenestrae, those of apical row smaller than those of proximal row; sternum consisting of a pair of hardly sclerotized plates. Last exposed sternum with flat apex.

Identified from a drawing by Mr P. Bonadona of aedeagus of a type (private communication).

Material examined. South Africa: Onrus [3419AC], 12.ii.1970, to meloid bait, 19 ♂♂, (J. C. van Hille) (AMSA); Storms River Mouth [3323DD], 18.ii.1970, 1 ♂, (J. C. van Hille) (AMSA); Simonstown [3418AB], 12–20.iv.1915, 2 ♂♂, 7 ♀♀, (Dr M. Cameron) (BMNH).

*Anthicus (Aulocoderus) bedfordi* **spec. nov.,** Figs 173–176

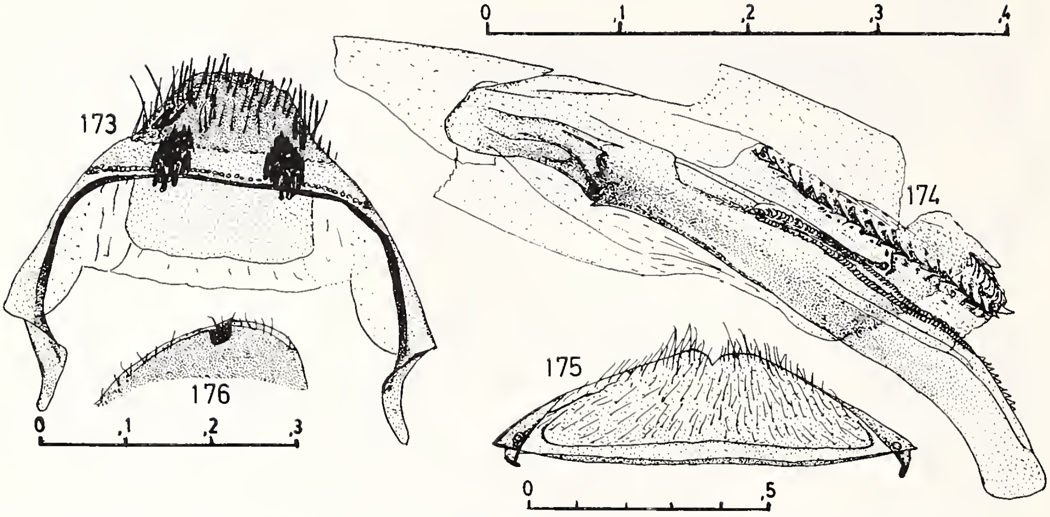
Size. Length 2,60 mm; width over broadest part of elytra 0,96 mm.

*Head*. Glossy, very dark testaceous; posterior arch broad, roundly diverging to eyes; punctures close and fine with procumbent hairs. Eyes small, slightly bulging.

*Prothorax*. Glossy, dark testaceous, broader than long, slightly broader than head; shoulders round; lateral constrictions close to base, connected by transverse dorsal groove having long hairs at sides but not in median region; punctures fine with recumbent hairs, slightly longer than on head.

*Elytra*. Dark testaceous with two pairs of light maculae with vague outline, anterior pair especially is indistinct in surface view as maculae are covered by glistening silvery hairs; posterior pair of maculae not covered by silvery hairs and therefore more visible; elongate in shape; male without apical point but with short dark notch (Fig. 176); punctures distinct, with recumbent hairs which are longer than on prothorax.

*Wings*. Fully developed.



Figs 173–176. *A.* (*A.*) *bedfordi* spec. nov. 173: retracted abdominal segment of male. 174: aedeagus. 175: last exposed abdominal sternum of male. 176: apex of elytron of male.

*Antennae*. Dark testaceous; apical three segments slightly broader but not darker; last segment almost as long as two preceding ones together.

*Legs*. Dark testaceous.

*Undersurface*. Dark testaceous.

*Male abdomen*. Aedeagus (Fig. 174): median lobe simple, laterally flattened, with very long genital opening with beaded margin; connecting membrane with dorsal row of about 28 teeth; tegmen with short apical piece and long basal piece. Retracted segment (Fig. 173): tergum with a pair of dark patches which consist of a group of short thick backward pointing hairs; in addition on each side a group of three similar hairs, lying laterally and distally to dark patches; with transverse row of fenestrae; sternum consisting of pair of narrow slightly sclerotized plates. Last exposed sternum (Fig. 175) with short apical indentation.

MATERIAL EXAMINED. South Africa: Johannesburg, Bedford Ridge [2628AA], xii.1949, Holotype ♂, Paratype ♂ (A. L. Capener) (AMSA); Middelburg, Transvaal [2429CD], 26.xi.1979, Paratype ♂ (J. C. van Hille) (AMSA).

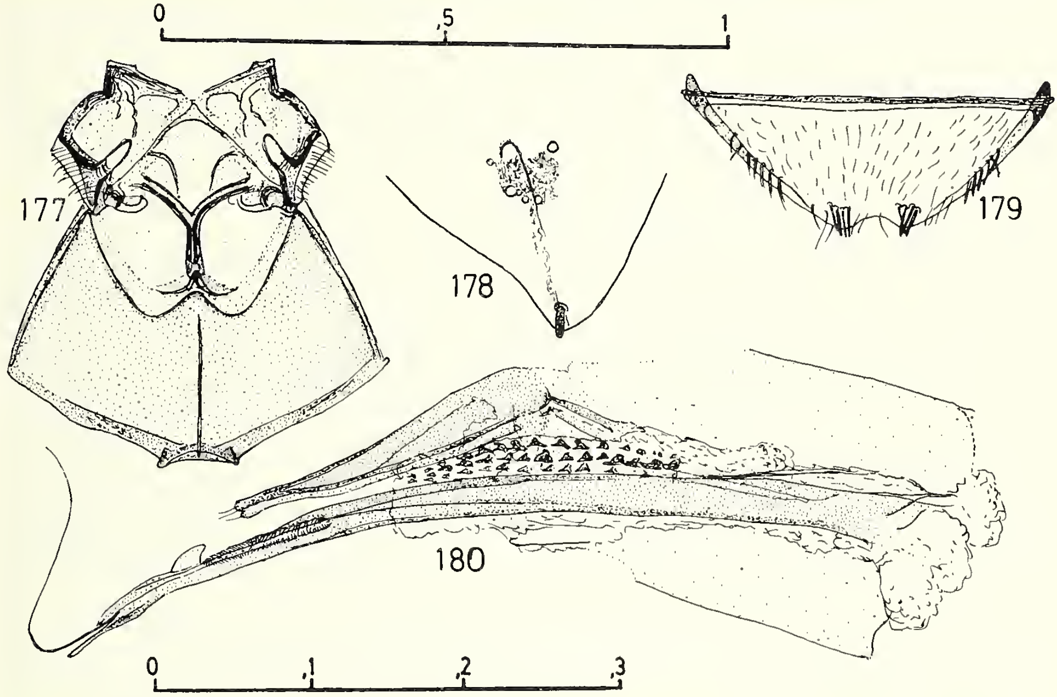
*Anthicus (Aulacoderus) munroi* **spec. nov.,** Figs 177–180

Size. Length 2,15 mm (2,10–2,20); width over broadest part of elytra 0,81 mm (0,75–0,88).

*Head*. Glossy, dark testaceous; posterior arch round; distinctly punctured, hairs fine and procumbent; pair of erect lateral hairs half-way between neck and eyes. Eyes large and bulging.

*Prothorax*. Glossy, testaceous, somewhat lighter than head; broader than long, narrower than head; shoulders slightly angular, each shoulder with a long erect hair; some more erect hairs on dorsal surface; punctures distinct but absent on basal region, hairs recumbent; lateral constrictions well developed at $\frac{4}{5}$ of the length of the prothorax, connected by a transverse dorsal depression.

*Elytra*. Glossy, testaceous with dark transverse bands at base and middle and slightly



Figs 177–180. *A.* (*A.*) *munroi* spec. nov. 177: meso- and metathoracic sterna. 178: apex of elytron of male, hairs omitted. 179: last exposed abdominal sternum of male. 180: aedeagus.

darker at apex; oval in shape with well developed shoulders; with very fine punctures having recumbent hairs of same colour as part of elytron on which they are implanted; with a number of erect hairs along lateral margins. In male with small apical point with small dark blunt spine and elongate notch (Fig. 178).

*Wings.* Fully developed.

*Antennae.* Testaceous; three apical segments darker and broader; last segment as long as two preceding ones together.

*Legs.* Testaceous.

*Undersurface.* Rather dark testaceous, with abdomen darker than thorax; mesepimerite apophyses (Fig. 177) with spiral markings at base only, apical part light and transparent.

*Male abdomen.* Aedeagus (Fig. 180): median lobe slender, with fine long curved apical hair, subapical dorsal hook and proximal to this hook the oblong genital opening with beaded margin; connecting membrane with 15 transverse rows of three teeth each; tegmen: apical piece slender, ending in two narrow lobes; basal piece less than one and a half times as long as apical piece. Retracted segment: tergum semi-circular with flattish hairy apex, transverse dark line and parallel row of fenestrae; sternum consisting of pair of narrow thin plates, each with apical hair. Last exposed tergum has on each side a group of about 10 dark spiny hairs. Last exposed sternum (Fig. 179) with apical indentation with on each side four dark spiny hairs and half-way between apex and base a lateral row of 6–7 dark spiny hairs.

Material examined. South Africa: Pilgrims Rest [2430DD], 2.xi.1950, Holotype ♂, Paratype ♂, (H. K. Munro) (NCI); Mogoto [2429AC], to meloid bait, 24.x.1979, Paratypes 11 ♂♂ (M. W. Mansell) (AMSA).

In several specimens from Mogoto the elytral gland is visible in the preparation as a granular mass with small droplets; there is also a granular strand along the apical notch to the apical spine. (Fig. 178).

*Anthicus (Aulacoderus) convexus* Pic, Figs 181–186

*Anthicus (Aulacoderus) convexus* Pic, 1903a: 169

Size. Length 1,81 mm (1,65–1,90); width over broadest part of elytra 0,79 mm (0,75–0,88).

*Head* (Figs 185–186). Glossy, testaceous; posterior arch longitudinally oval; ventrally with median dark area from neck to base of labium, without punctures or hairs; dorsally with fine somewhat widely spaced punctures with fine procumbent hairs. Eyes bulging.

*Prothorax.* (Fig. 186). Glossy, testaceous, basal area lighter; slightly longer than broad, as broad as head; shoulders sloping and round; punctures coarser and closer than on head but absent on basal area; with fine recumbent hairs; lateral constrictions at $\frac{2}{3}$ of the length of the prothorax, with long hairs.

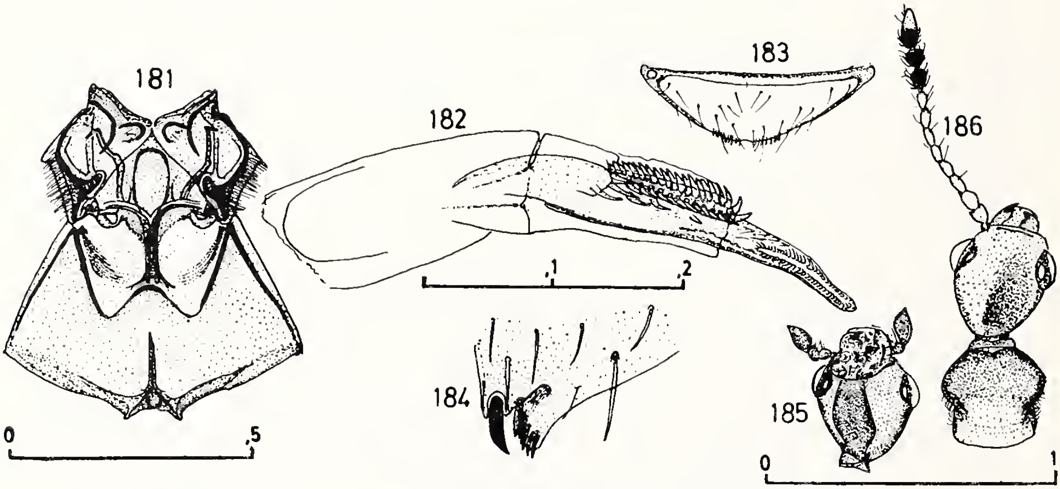
*Elytra.* Glossy, testaceous; oval, narrowing to apex; punctures coarser and more widely spaced than on prothorax and with recumbent hairs, longer than on prothorax; with a number of erect and semi-erect hairs along lateral margins. Male with oblique apical notch (Fig. 184) with a stout dark spine on its median side and a group of about six spiny hairs on lateral side.

*Wings.* Fully developed.

*Antennae* (Fig. 186). Slender, light testaceous; apical three segments broader and darker but apical half of last segment testaceous; last segment almost as long as two preceding ones together.

*Legs.* Light testaceous.

*Undersurface.* Testaceous; mesocoxal cavities angularly drawn out to the back (Fig. 181).



Figs 181–186. *A.* (*A.*) *convexus* Pic. 181: meso- and metathoracic sterna. 182: aedeagus. 183: last abdominal sternum of male. 184: apex of elytron of male. 185: head, ventral view. 186: head and prothorax, dorsal view.

*Male abdomen.* Aedeagus (Fig. 182): median lobe slender with elongate apical genital opening with beaded margin; connecting membrane with dorsal row of about 30 single teeth and about six non-aligned teeth near attachment of connecting membrane to base of median lobe; tegmen: basal piece more than three times as long as apical piece. Retracted segment: tergum with dark transverse line and uninterrupted proximal row of fenestrae; sternum consisting of pair of triangular non overlapping plates each with one apical hair. Last exposed sternum (Fig. 183) apically somewhat flat with some short spine-like hairs on each side of apex.

MATERIAL EXAMINED. South Africa: Malvern [2930DD], vi.1897, Type ♂, Pic det., (G. A. K. Marshall) (NMNH); Port St Johns [3129DA], vii–viii.1923 and vii.1929, 1 ♂, 2 ♀♀, Krekich det., (R. E. Turner) (BMNH); Eshowe [2831CD], vi–vii.1926, 3 ♂♂, (R. E. Turner) (BMNH).

*Anthicus (Aulacoderus) mediofasciatus* Pic, Figs 187–192

*Anthicus (Aulacoderus) mediofasciatus* Pic, 1903b: 184

Size. Length 1,83 mm (1,55–1,97); width over broadest part of elytra 0,76 mm (0,60–0,83).

*Head* (Fig. 192). Glossy, testaceous; posterior arch round with an erect hair on each side; punctures fine with short procumbent hairs. Eyes bulging.

*Prothorax* (Fig. 192). Glossy, testaceous, slightly lighter than head; broader than long, narrower than head; with two pairs of lateral angles, each with erect lateral hair; punctures fine with fine recumbent hairs; lateral constrictions at $\frac{4}{5}$ of the length of the prothorax, with long hairs.

*Elytra.* Glossy, usually plain testaceous but in some specimens with dark area in middle of each elytron which may reach median suture, thus forming an incomplete transverse band; in addition a darker basal area may occur in some specimens; the two elytra together are oval in shape, with round shoulders; punctures fine, with recumbent hairs somewhat longer than on prothorax and with a number of longer erect hairs along posterior lateral margin.

*Wings.* Fully developed in both sexes.

*Antennae* (Fig. 192). Plain testaceous or apical 3–4 segments slightly darker; last segment as long as two preceding ones together.

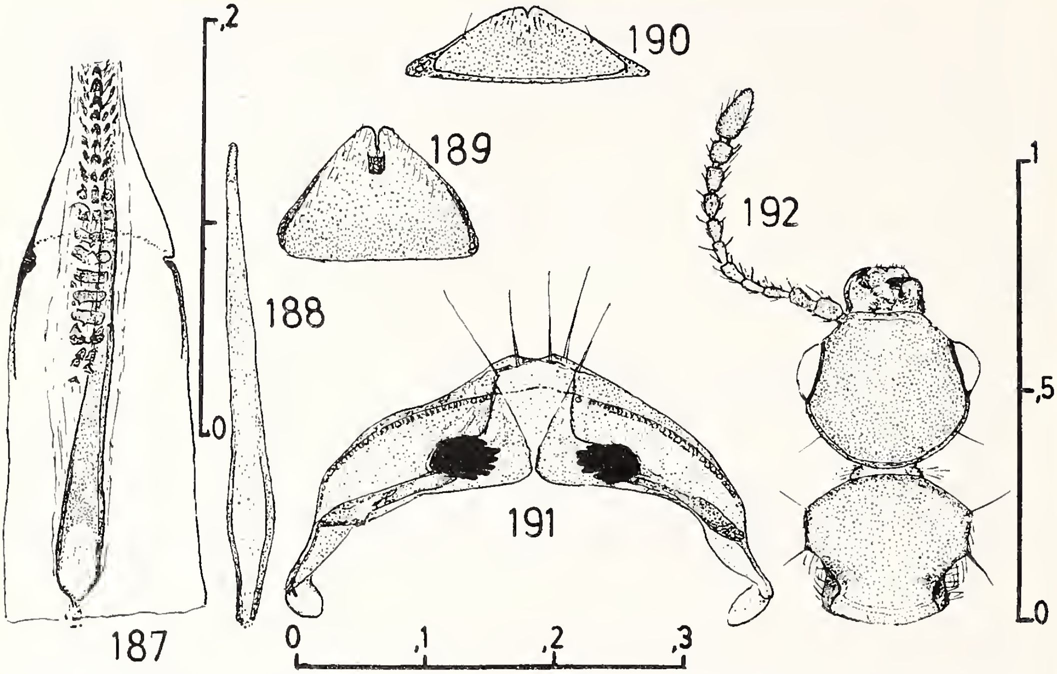
*Legs.* Testaceous.

*Undersurface.* Light testaceous, with sparse hairs.

*Male abdomen.* Aedeagus (Fig. 187): median lobe (Fig. 188) simple in shape with small oval genital opening with very finely beaded margin; connecting membrane with about 21 transverse rows of teeth which occur in threes in the region near the attachment to apical piece of tegmen but become fused to irregular shapes near attachment to base of median lobe; tegmen with basal piece about twice as long as apical piece. Retracted segment (Fig. 191): tergum with transverse row of small fenestrae, interrupted in the middle; sternum consists of two short sclerites of which distal margins are fused onto tergum; each sternal sclerite with black patch consisting of about ten short black bars which are held in a pouch which is open towards the median line (after dehydration these bars are brittle and when manipulated, break off with sharp edges), this structure does not occur in females and has not been found in any other species of *Aulacoderus*, function unknown. Last exposed sternum (Fig. 190) with short sharp apical indentation.

*Female abdomen.* Last exposed tergum (Fig. 189) with short sharp apical groove leading into a rectangular duplication of the integument.

MATERIAL EXAMINED. South Africa: Port St Johns [3129DA], 1–5.v.1923, 1 ♂, Krekich det., 1 ♂, (R. E. Turner) (BMNH); Mossel Bay [3422AA], v.1921, 1 ♂, (R. E. Turner)



Figs 187–192. *A.* (*A.*) *mediofasciatus* Pic. 187: aedeagus. 188: median lobe of aedeagus. 189: last exposed abdominal tergum of female. 190: last exposed abdominal sternum of male. 191: retracted abdominal segment of male. 192: head and prothorax.

(BMNH); Grahamstown [3326BC], to meloid bait, 17–29.vi.1948, 4 ♂♂, (J. C. van Hille) (AMSA); Grahamstown [3326BC], to light, iv.1951, 1 ♀, (B. Stuckenberg) (AMSA); Grahamstown [3326BC], Rhodes University Grounds, to meloid bait, x–xi.1952, 4 ♂♂, (J. C. van Hille) (AMSA); Sundays River Mouth [3325DB], 20.ix.1953, 1 ♂, (J. C. van Hille) (AMSA); Pirie Forest [3227CC], 4.xii.1954, 1 ♂, (L. Vári) (AMSA); Jansenville, Fairview [3227DC], 23.xi.1969, 2 ♂♂, (J. C. van Hille) (AMSA); Pluto's Vale [3326BA], to meloid bait, 28.ii.1979, 5 ♂♂, (J. C. van Hille) (AMSA).

*Anthicus (Aulacoderus) schimperi* Pic, Figs 193–197

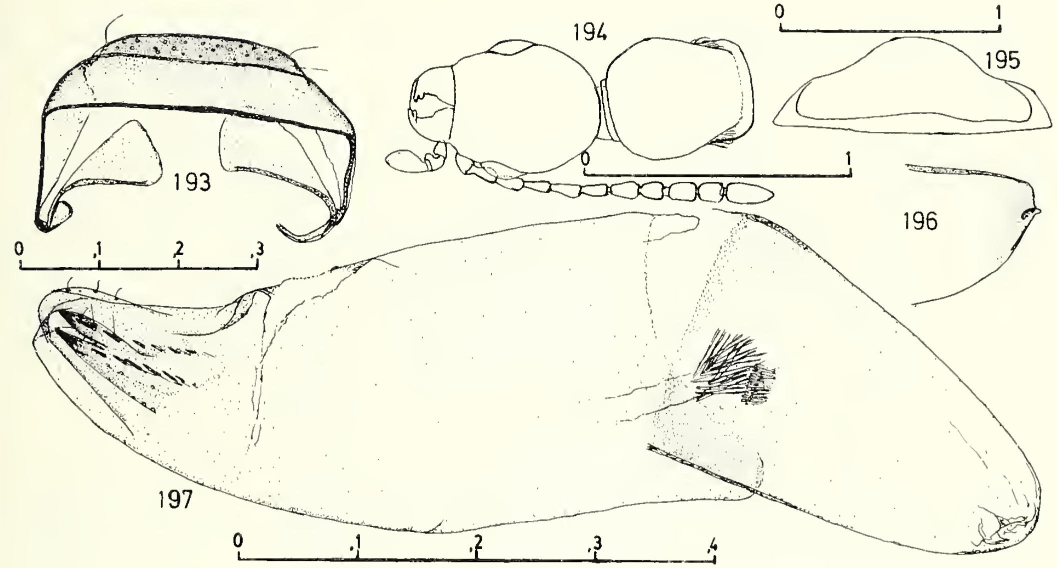
*Anthicus schimperi* Pic, 1898: 70

Size. Length 2,40 mm (2,12–2,90); width over broadest part of elytra 0,84 mm (0,80–0,88).

*Head* (Fig. 194). Glossy, black; posterior arch longitudinally oval; with fine punctures and fine silvery procumbent hairs. Eyes slightly bulging.

*Prothorax* (Fig. 194). Glossy, black, longer than broad, narrower than head; shoulders round; with fine punctures having silvery recumbent hairs; lateral constrictions shallow and with long lateral hairs.

*Elytra.* Somewhat glossy, black, elongate, rather closely punctured, with silvery recumbent hairs longer than on prothorax. In male with short apical notch and short point (Fig. 196).



Figs. 193–197. *A.* (*A.*) *schimperi* Pic. 193: retracted abdominal segment of male. 194: head and prothorax. 195: last exposed abdominal sternum of male. 196: apex of elytron of male. 197: aedeagus.

*Wings*. Well developed.

*Antennae* (Fig. 194). Dark testaceous; apical five segments gradually broader; last segment shorter than two preceding ones together.

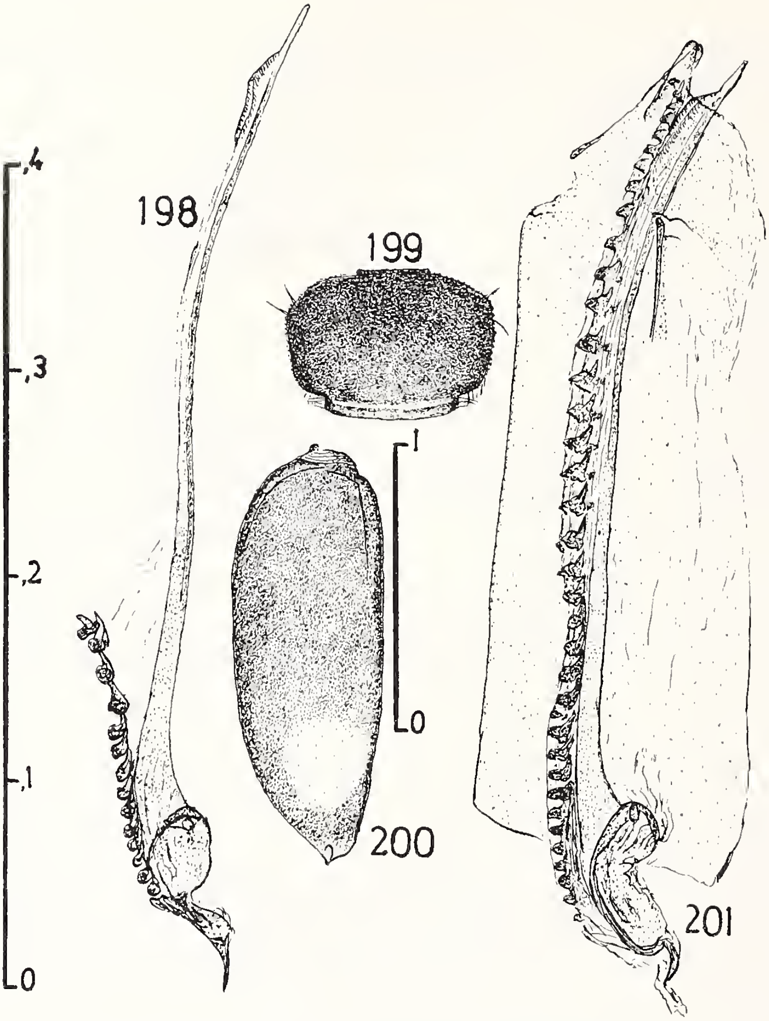
*Legs*. Dark testaceous.

*Undersurface*. Dark testaceous to black.

*Male abdomen*. Aedeagus (Fig. 197): median lobe hardly sclerotized, ending in a pair of blunt lobes; connecting membrane with two longitudinal rows of seven fine teeth each; tegmen: apical and basal piece ventrally separated but dorsally continuous; apical piece ending in a pair of bluntly pointed lobes; at base of basal piece are two sets of spines, apparently surrounding ejaculatory duct; spines of distal ring longer than those of proximal ring; basal cap elongate. Retracted segment (Fig. 193): tergum broad with flat apex and transverse dark line, without row of fenestrae; sternum consisting of pair of thin triangular plates. Last exposed sternum (Fig. 195) with flat apex, laterally slightly excavated.

MATERIAL EXAMINED. Ethiopia: no date, Cotypes 5 ♂♂, (Schimper) (MNHN). N.E. Ethiopia: Tigré, no date, 3 ♂♂, Pic det., (no collector) (NMW).

In the description and in the Catalogus Coleoptorum (Pic 1913) this species is referred to as *Anthicus schimperi* Pic; no mention is made of the fact that it belongs to the subgenus *Aulacoderus* although the next species on the same page is called *Anthicus (Aulacoderus) bouvieri* n. sp. However, Pic mentions in the description that in *A. schimperi* the elytra are apically pointed and that the basal groove of the prothorax is laterally provided with white hairs, both features by which *Aulacoderus* differs from the other species of the genus *Anthicus.*



Figs 198–201. *A.* (*A.*) *morani* spec. nov. 198: median lobe of aedeagus with part of connecting membrane. 199: prothorax. 200: elytron of male. 201: aedeagus.

*Anthicus (Aulacoderus) morani* **spec. nov.**, Figs 198–201.

Size. Length 2,41 mm (2,28–2,65); width over broadest part of elytra 1,00 mm (0,87–1,06).

*Head*. Slightly glossy, black; posterior arch almost rectangular with rounded angles toward eyes; with close punctures and short procumbent hairs. Eyes rather bulging.

*Prothorax* (Fig. 199). Slightly glossy, black, broader than long, broader than head; punctures close with short recumbent hairs and a number of erect hairs; lateral constrictions at $\frac{9}{10}$ of the length of the prothorax, with shortish hairs.

*Elytra* (Fig. 200). Somewhat glossy, black with a pair of subapical testaceous maculae which may appear orangy-red; punctures smaller and shallower than on head and prothorax, with fine recumbent hairs, longer than on prothorax, and several erect hairs, especially along posterior half of lateral margins.

*Wings*. Fully developed.

*Antennae*. Testaceous; apical 3–4 segments broader and darker.

*Legs*. Testaceous, coxae and femora darker.

*Undersurface*. Thorax testaceous, abdomen dark testaceous to black.

*Male abdomen*. Aedeagus (Fig. 201): median lobe (Fig. 198) long and very slender, with pointed apex and subapical genital opening with finely beaded margin; connecting membrane with about 35 single teeth; tegmen little sclerotized, basal piece three times as long as apical piece. Retracted segment: tergum with row of fenestrae, interrupted in middle; sternum consisting of a pair of elongate triangular plates. Last exposed sternum apically slightly indented.

MATERIAL EXAMINED. Rhodesia (now Zimbabwe): 50 miles east of Salisbury (now Harare), Holotype ♂, Paratypes 9 ♂♂, (V. C. Moran & C. N. Smithers) (AMSA).

*Anthicus (Aulacoderus) chicarubiensis* **spec. nov.**, Figs 202–206

Size. Length 2,30 mm (2,08–2,57); width over broadest part of elytra 0,86 mm (0,80–1,05).

*Head*. Somewhat glossy, testaceous to dark testaceous; posterior arch broadly round; with short procumbent hairs and a pair of erect lateral hairs between eyes and neck. Eyes somewhat bulging.

*Prothorax*. Somewhat glossy, testaceous, lighter than head; shoulders sloping to lateral angles; each angle with long erect hair which is longer in male than in female; another pair of erect hairs in male half-way between shoulder angle and lateral constriction; in female this pair of erect hairs is absent; broader than long, narrower than head; punctures very fine with recumbent hairs; lateral constrictions at $\frac{3}{4}$ of the length of the prothorax.

*Elytra* (Fig. 204). Hardly glossy, testaceous with variable dark markings: usually with dark testaceous transverse band, just in front of middle which may, or may not, reach median suture; base and apex may be somewhat darker but in some specimens the dark markings are almost or completely absent; punctures larger and hairs longer than on prothorax.

*Wings*. Fully developed.

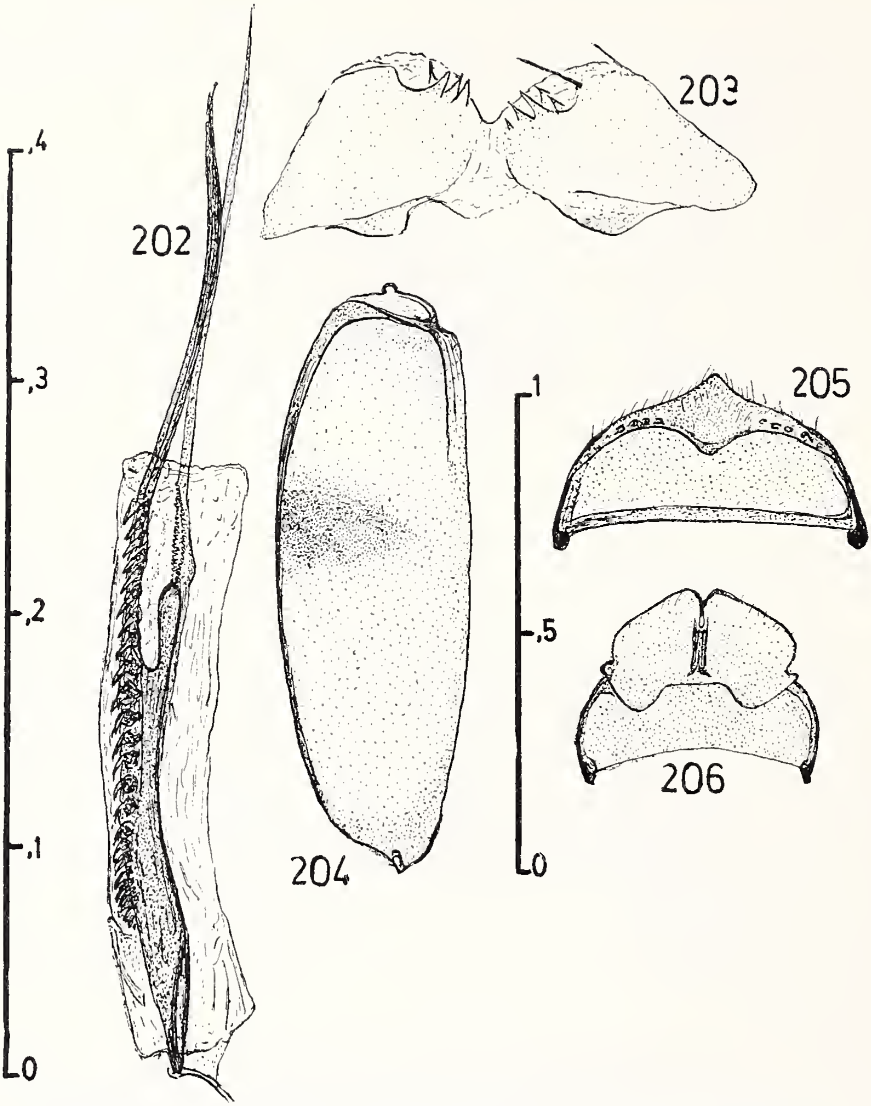
*Antennae*. Light testaceous; apical three segments darker and broader; last segment longer than two preceding ones together.

*Legs*. Testaceous.

*Undersurface*. Thorax testaceous, abdomen dark testaceous to black.

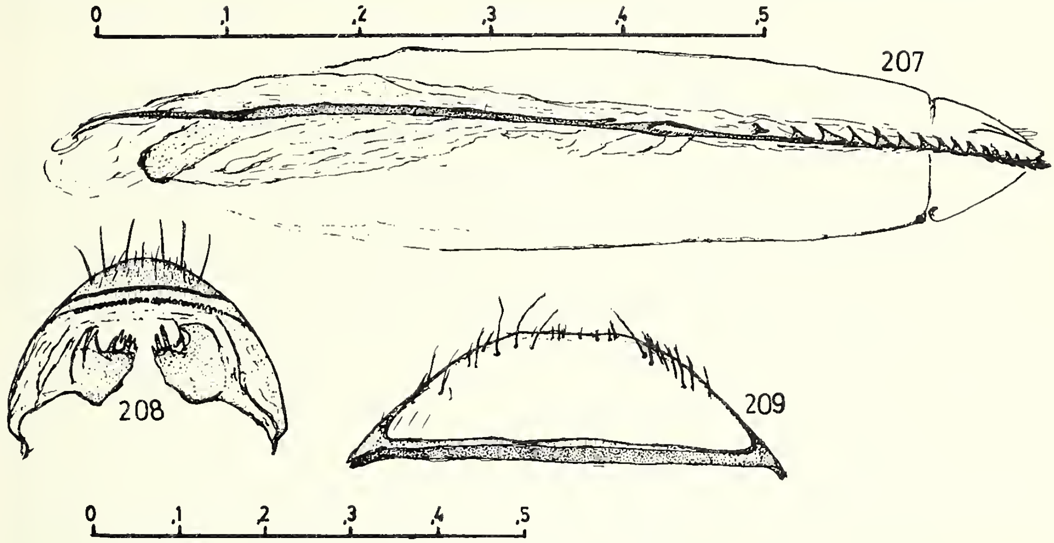
*Male abdomen*. Aedeagus (Fig. 202): median lobe with long point distal to genital opening; a dorsal spine attached proximally to genital opening is almost as long as the elongate apical point; connecting membrane with about 30 single teeth; tegmen with basal piece about five times as long as apical piece. Retracted segment: tergum with transverse dark line and parallel proximal row of fenestrae; sternum (Fig. 203) divided into two plates, very little sclerotized, with on each side 4–5 backwards pointing soft spines. Last exposed sternum rather long, apically very slightly indented.

*Female abdomen*. Last exposed tergum (Fig. 206) apically divided in two and with ventral margined groove; proximal to this groove tergum has a curved transverse line. Last exposed sternum (Fig. 205) apically pointed with inwards folded margin on dorsal surface with 5–6 blunt tubercles on each side.



Figs 202–206. *A.* (*A.*) *chicarubiensis* spec. nov. 202: aedeagus. 203: sternum of retracted abdominal segment of male. 204: elytron of male. 205: last exposed abdominal sternum of female. 206: last exposed abdominal tergum of female.

MATERIAL EXAMINED. Rhodesia (now Zimbabwe): Chicarubi Estate near Salisbury (now Harare), 2.xii.1956, Holotype ♂, Paratypes 9 ♂♂, (C. N. Smithers) (AMSA); Salisbury (now Harare), 19.i.1957, Paratypes 10 ♂♂ (R. M. Arnold) (AMSA); Salisbury (now Harare), Edge of maize field, 12.ii.1957, Paratypes 6 ♂♂, (C. N. Smithers) (AMSA); Salisbury (now Harare), The Grange, sweeping at dusk, i-ii.1894, Paratype 1 ♂, (G. A. K. Marshall) (BMNH).



Figs 207–209. *A.* (*A.*) *stephani* spec. nov. 207: aedeagus. 208: retracted abdominal segment of male. 209: last exposed abdominal sternum of male.

*Anthicus (Aulacoderus) stephani* **spec. nov.,** Figs 207–209

Size. Length 1,83 mm (1,78–1,91); width over broadest part of elytra 0,71 mm (0,65–0,75).

*Head.* Somewhat glossy, testaceous to dark testaceous; posterior arch broadly round; with fine punctures and short white procumbent hairs; a pair of long lateral erect hairs half-way between eyes and neck. Eyes with dark margin, not much bulging.

*Prothorax.* Somewhat glossy, testaceous, lighter than head; broader than long, almost as broad as head; shoulders sloping and angular, with long erect lateral hair on angle and another pair of lateral erect hairs half-way between shoulder and posterior margin. Punctures fine, with short white recumbent hairs; lateral constrictions at $\frac{3}{4}$ of length of prothorax.

*Elytra.* Hardly glossy, testaceous with darker area just before middle, not sharply outlined and reaching neither lateral margin nor median suture; punctures fine with recumbent hairs, not much longer than on prothorax; with a number of erect hairs, especially along lateral margins and on apical area.

*Wings.* Fully developed.

*Antennae.* Testaceous, three apical segments darker and broader; last segment as long as two preceding ones together.

*Legs.* Light testaceous.

*Undersurface.* Testaceous, abdomen darker than thorax.

*Male abdomen.* Aedeagus (Fig. 207): median lobe very thin and long, with subapical genital opening with finely beaded margin; with small blunt dorsal spine proximal to genital opening; connecting membrane with dorsal row of about 17 single teeth; tegmen little sclerotized, with basal piece five times as long as apical piece. Retracted segment (Fig. 208): tergum with transverse subapical dark line and parallel row of fenestrae; sternum consisting of pair of thin plates with an asymmetrical arrangement of backward pointing soft spines. Last exposed sternum (Fig. 209) with flat apex.

Material examined. South Africa: 16 miles west of Pretoria [2527DB], 26.xii.1952, Holotype ♂, Paratypes 3 ♂♂, (C. N. Smithers) (AMSA).

*Anthicus (Aulacoderus) nemoralis* **spec. nov.,** Figs 210–213

Size. Length 2,70 mm; width over broadest part of elytra 0,95 mm.

*Head* (Fig. 212). Glossy, dark testaceous; posterior arch round; with fine punctures and short, somewhat irregular procumbent hairs. Eyes large and bulging.

*Prothorax* (Fig. 212). Glossy, lighter testaceous than head; longer than broad, narrower than head; shoulders much sloping; punctures fine with fine short somewhat irregularly recumbent hairs; lateral constrictions in front of posterior third, with long hairs.

*Elytra.* Glossy, light testaceous to testaceous, surrounded by dark margin which is broader along median suture than along lateral margins; light central area reaches lateral margins only just behind shoulders; punctures coarser and more widely spaced than on prothorax.

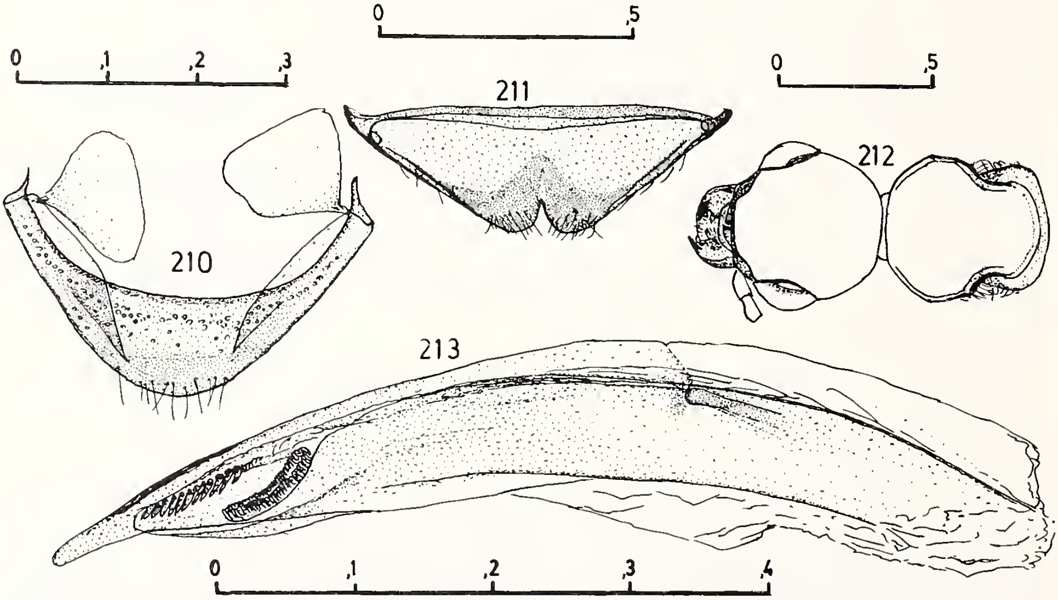
*Wings.* Fully developed.

*Antennae.* First two segments light testaceous, the rest is missing in the only specimen available.

*Legs.* Light testaceous.

*Undersurface.* Testaceous, abdomen darker than thorax; mesocoxal cavities somewhat elongated backwards but not as much as in *A. convexus* (Fig. 181).

*Male abdomen.* Aedeagus (Fig. 213): median lobe dorsally convex; with oval subapical genital opening with prominently grooved margin; connecting membrane with dorsal row of about 11 single teeth; tegmen: basal piece shorter than apical piece which ends in a single blunt apex. Retracted segment (Fig. 210): tergum with round apex with some long hairs and a rather irregular arrangement of fenestrae; sternum consisting of a pair of broad short thin plates. Last exposed sternum (Fig. 211) with sharp apical indentation.



Figs 210–213. *A.* (*A.*) *nemoralis* spec. nov. 210: retracted abdominal segment of male. 211: last exposed abdominal sternum of male. 212: head and prothorax. 213: aedeagus.

Material examined. Ivory Coast: Tonkoui, C. I. Forêt prim. 900–1 200 m, 20–30.ix.1946, Holotype ♂, (A. Villiers) (NMW).

The specimen has two labels, both in Pic's handwriting:

(1) 'ressemble un peu à *massarti* Pic'
(2) 'plus robuste, élytres moins rétrécis en avant, moins clairs'.

*Anthicus (Aulacoderus) minimus* Pic, Figs. 214–218
*Anthicus (Aulacoderus) minimus* Pic, 1952a: 79

Size. Length 1,57 mm (1,35–1,70); width over broadest part of elytra 0,59 mm (0,55—0,63).

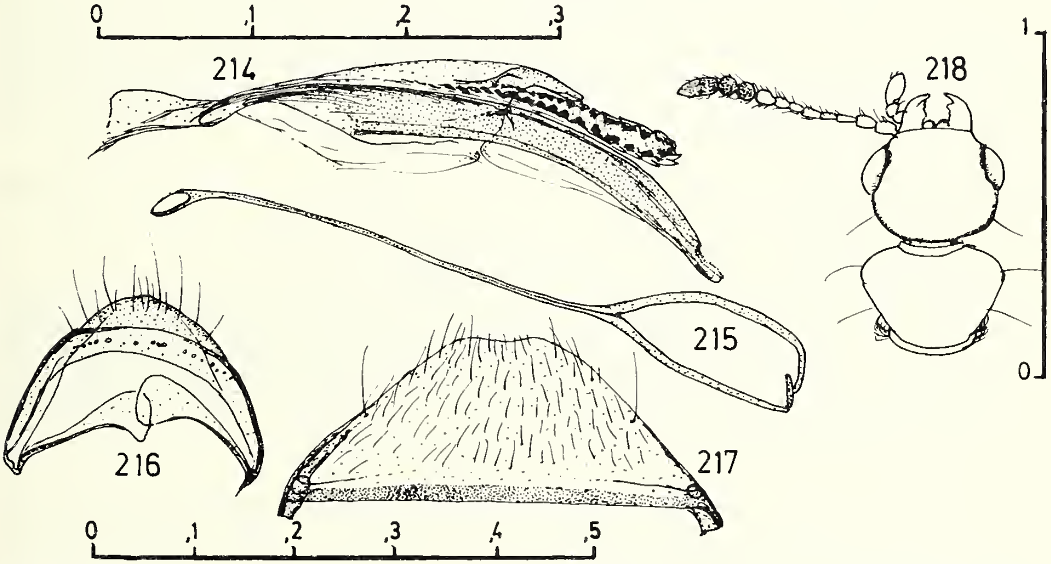
*Head* (Fig. 218). Glossy, testaceous to dark testaceous; posterior arch broadly round, with a pair of erect lateral hairs behind eyes; punctures fine with short procumbent hairs. Eyes rather large and bulging.

*Prothorax* (Fig. 218). Light testaceous to testaceous; broader than long, broader than head; shoulders round; with two pairs of long erect lateral hairs; lateral constrictions inconspicuous but well supplied with hairs forming a basal hairband; punctures closer than on head, hairs longer and recumbent.

*Elytra*. Somewhat glossy, testaceous without markings, a little darker than prothorax but lighter than head; with round shoulders; with fine punctures and recumbent hairs, longer than on prothorax; with a number of longer erect and semi-erect hairs.

*Wings*. Reduced, shorter than elytra.

*Antennae* (Fig. 218). Light testaceous, apical three segments somewhat darker and broader; last segment almost as long as two preceding ones together.



Figs 214–218. *A.* (*A.*) *minimus* Pic. 214: aedeagus. 215: spiculum gastrale of male. 216: retracted abdominal segment of male. 217: last exposed abdominal sternum of male. 218: head and prothorax.

*Legs.* Light testaceous.

*Undersurface.* Testaceous, abdomen darker than thorax.

*Male abdomen.* Aedeagus (Fig. 214): median lobe simple, ventral side concave, with small apical genital opening; connecting membrane with dorsal row of 28 single teeth; tegmen little sclerotized, basal piece longer than apical piece. Retracted segment (Fig. 216): tergum with transverse subapical dark line and parallel more proximal row of fenestrae, interrupted in the middle; sternum consisting of a pair of thin plates, broadening toward apex. Spiculum gastrale (Fig. 215) very slender, the two Y-arms turned inwards. Last exposed sternum (Fig. 217) with flat apex, hardly indented.

MATERIAL EXAMINED. Congo (now Zaire): Lulua, Kapanga, iii.1933, 3 ♂♂, (F. G. Overlaet) (MRAC).

These specimens were named by P. Bonadona; they were collected at the type locality by the same collector who collected the type a month later.

### *Anthicus (Aulacoderus) simoni* Pic, Figs 219–222

*Anthicus (Aulacoderus) simoni* Pic, 1895a:106

Size. Length 1,86 mm (1,70–2,05); width over broadest part of elytra 0,68 mm (0,58–0,75).

*Head.* Glossy, testaceous; posterior arch semi-circular, slightly diverging to eyes; with fine procumbent hairs. Eyes slightly bulging.

*Prothorax* (Fig. 222). Less glossy than head, light testaceous to testaceous; longer than broad, narrower than head; with round sloping shoulders; punctures very fine with recumbent hairs; lateral constrictions at ¾ of the length of the prothorax, with fine hairs.

*Elytra* (Fig. 221). Glossy, light testaceous with dark transverse band in middle and narrow dark line near apex, not always reaching lateral margins but extending forward along median suture; in some specimens the whole posterior half is dark. Behind dark band in middle the elytra narrow to apex. In some specimens the posterior half appears milky white; this is the area where the elytral gland lies in males which opens at apical notch. Punctures very fine with dark recumbent hairs, but light hairs in front of transverse dark line.

*Wings.* Fully developed.

*Antennae.* Testaceous, last three segments somewhat darker and broader; last segment shorter than two preceding ones together.

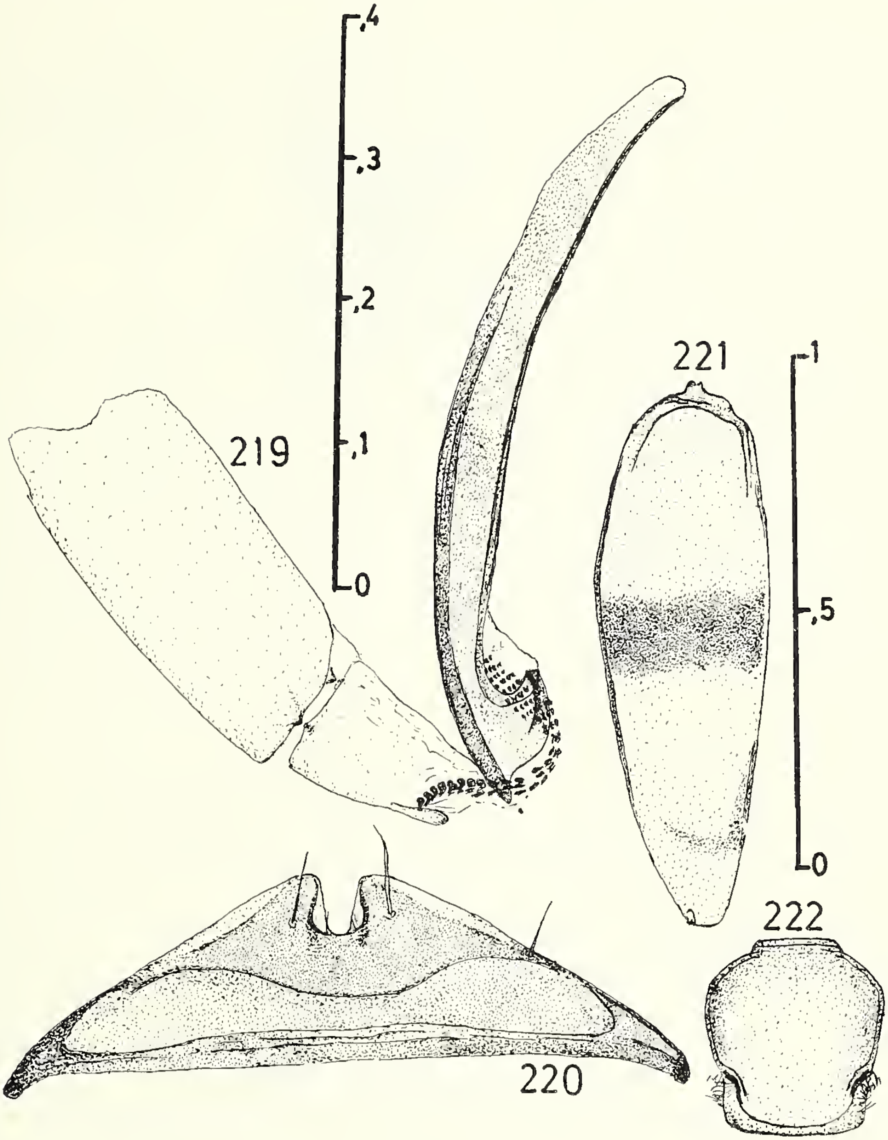
*Legs.* Light testaceous.

*Undersurface.* Testaceous, abdomen darker than thorax.

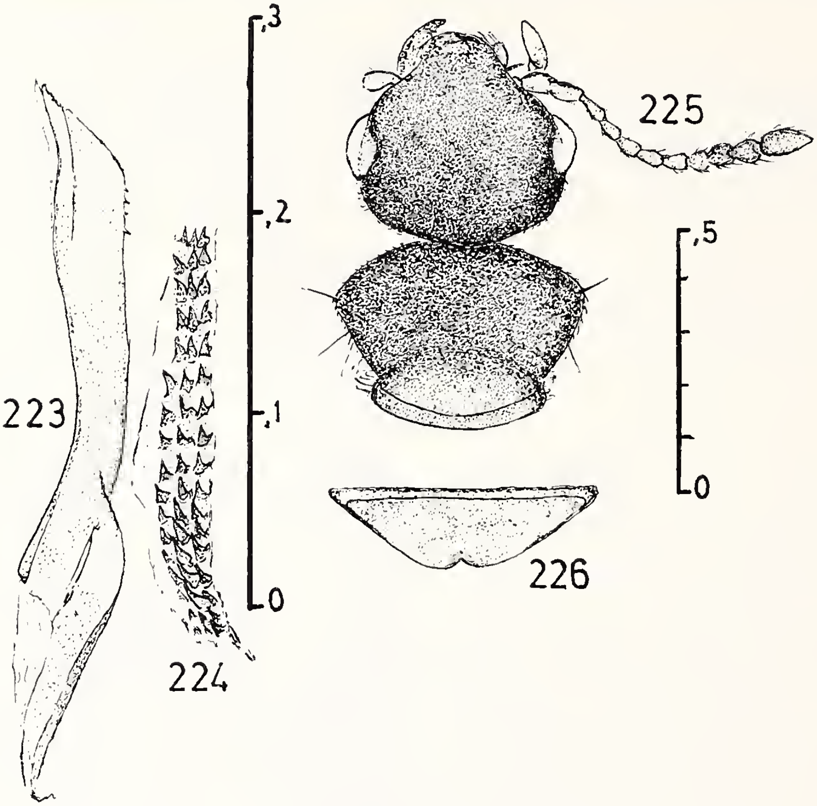
*Male abdomen.* Aedeagus (Fig. 219): median lobe ventrally concave with broad ventral basal hook; genital opening apical without beaded margin; connecting membrane with about 27 transverse rows of up to 5 teeth each; tegmen lightly sclerotized, basal piece more than twice as long as apical piece. Retracted segment: tergum with transverse row of fenestrae, interrupted in middle, without dark transverse line; sternum consisting of pair of narrow sclerites. Last exposed sternum (Fig. 220) with round apical identation.

Identified from drawing of P. Bonadona (private communication).

MATERIAL EXAMINED. South Africa: 16 miles west of Pretoria [2527DB], to meloid bait, 26.xii.1952, 62 ♂♂, (C. N. Smithers) (AMSA).



Figs 219–222. *A.* (*A.*) *simoni* Pic. 219: aedeagus. 220: last exposed abdominal sternum of male. 221: elytron of male. 222: prothorax.



Figs 223–226. *A.* (*A.*) *inopinans* Krek. 223: median lobe of aedeagus. 224: part of dorsal row of teeth of connecting membrane of aedeagus. 225: head and prothorax. 226: last exposed abdominal sternum of male.

*Anthicus (Aulacoderus) inopinans* Krekich, Figs 223–226

*Anthicus (Aulacoderus) inopinans* Krekich, 1914: 5

Size. Length 1,90 mm (1,77–2,25); width over broadest part of elytra 0,73 mm (0,62–0,83).

*Head* (Fig. 225). Glossy, dark testaceous to black; posterior arch broad with round angles towards eyes, with short procumbent hairs. Eyes somewhat bulging.

*Prothorax* (Fig. 225). Somewhat glossy, same colour as head; broader than long, broader than head; shoulders slightly angular; with fine recumbent hairs, slightly denser than on head and two pairs of erect lateral hairs; lateral constrictions at $\frac{5}{6}$ of the length of the prothorax, with fine long hairs.

*Elytra*. Glossy, dark testaceous, lighter than head and prothorax; rather short and broad; recumbent hairs longer than on prothorax; a few semi-erect longer hairs along posterior half of lateral margins.

*Wings*. Fully developed.

*Antennae* (Fig. 225). Dark testaceous, four apical segments gradually somewhat darker and broader; last segment as long as two preceding ones together.

*Legs*. Dark testaceous.

*Undersurface*. Dark testaceous.

*Male abdomen*. Aedeagus: median lobe (Fig. 223) with five minute spines on dorsal margin; genital opening apical with very finely beaded margin; connecting membrane (Fig. 224) with about 25 transverse rows of three teeth each; tegmen lightly sclerotized with bluntly pointed apex. Retracted segment: tergum with dark transverse line separating darker apical from lighter proximal area, latter has transverse row of fenestrae in its middle; sternum consisting of a pair of narrow curved sclerites. Last exposed sternum (Fig. 226) with small apical indentation.

Material examined. Deutsch Ost Afrika (now Tanzania): Vulkangebiet am Kivu, no date, Types 6 ♂♂, det. Krekich, (S. G. Schlobach) (NMW).

The locality of this species is problematic. Lake Kivu lies between Zaire and Ruanda and was never part of Tanzania (Deutsch Ost Africa or Tanganyika). The volcanic area probably refers to the Virunga Mountains which lie north-east of Lake Kivu in Ruanda and south-west Uganda. It is doubtful whether the mountains in the west of Tanzania can be considered as part of the volcanic area. (For this information the author is indebted to Miss C. E. Bos, Cand. soc. Geogr., Amsterdam).

Krekich mentions that these specimens were found in a parcel of large Scarabaeidae, sent by Major Schlobach from Deutsch Ost Africa. The contents had gone mouldy and in the packet were found 286 specimens of this *Aulacoderus* which were all males. Krekich suggests a parallel with observations he made on *Formicomus gestroi* Pic where males and females should have different times of hatching and different lifespans. It seems more probable that among the mouldy Scarabaeidae were some Meloidae which attracted the *Aulacoderus* males. As the parcel was sent off from Tanzania; it may well be that the *Aulacoderus* males are from Tanzania and have never been near Lake Kivu.

*Anthicus (Aulacoderus) termitophilus* Pic, Figs 227–230
*Anthicus (Aulacoderus) termitophilus* Pic, 1952b: 22

Size. Length 1,79 mm (1,77–1,80); width over broadest part of elytra 0,64 mm (0,60–0,68).

*Head* (Fig. 230). Glossy, black; posterior arch broadly round; coarsely and densely punctured, with fine grey procumbent hairs and a pair of lateral erect hairs on posterior margin, half-way between eyes and neck. Eyes not much bulging.

*Prothorax* (Fig. 230). Glossy, dark testaceous to black; broader than long, broader than head; coarse and dense punctures with grey recumbent hairs, coarser than on head; lateral constrictions inconspicuous, represented by a pair of densely hairy patches; base with narrow margin.

*Elytra*. Dark testaceous, elongate; punctures finer than on prothorax, especially in apical region; hairs recumbent, rather coarse and longer than on prothorax; with many erect hairs, especially on shoulders and along lateral margins of apical region. Male with elongate apical notch (Fig. 228).

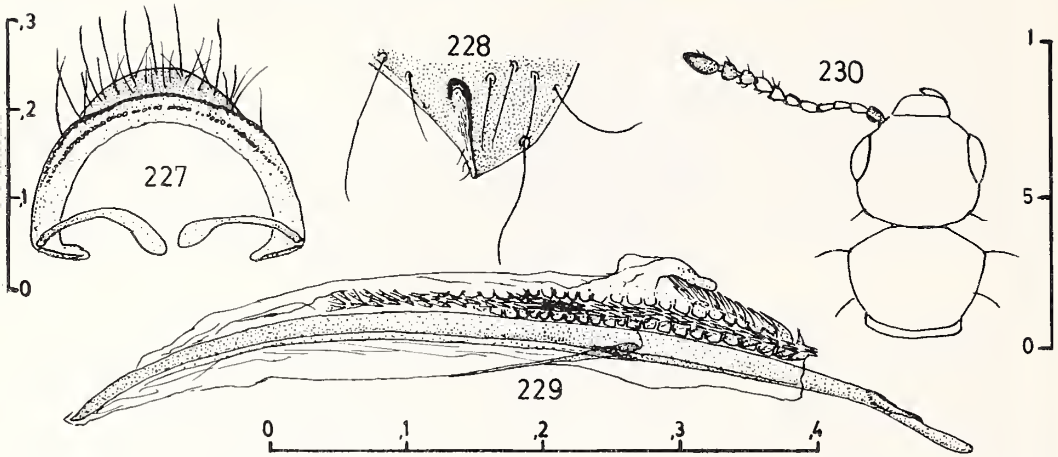
*Wings*. Fully developed.

*Antennae* (Fig. 230). Testaceous, rather short; first proximal and apical three segments somewhat broader and little darker; last segment as long as two preceding ones together.

*Legs*. Testaceous, femora and tibiae darker.

*Undersurface*. Dark testaceous.

*Male abdomen*. Aedeagus (Fig. 229): median lobe ventrally convex, with blunt apex and



Figs 227–230. *A.* (*A.*) *termitophilus* Pic. 227: retracted abdominal segment of male. 228: apex of elytron of male. 229: aedeagus. 230: head and prothorax.

subapical genital opening with beaded margin; connecting membrane with about 50 transverse rows of three teeth each, only near attachment to tegmen the teeth are single; tegmen membranous, basal piece four times as long as apical piece. Retracted segment (Fig. 227): tergum semi-circular with dark transverse ridge and parallel proximal row of fenestrae; sternum consisting of a pair of narrow sclerites. Last exposed sternum with small apical indentation. Contents of rectum consist of some debris and some dark fungus spores.

MATERIAL EXAMINED. Congo (now Zaire): Massif des Kundelungu, dans une petite termitière épigée, 15.i.1949, 2 ♂♂, (N. Leleup) (MRAC).

As these two specimens were collected at the same time as the type and at the type locality, they must form part of the type series.

There seem to be no anatomical adaptations to life in a termite heap.

## SECTION 7

In the ten species of this section the median lobe of the aedeagus has a narrow ventral apical or subapical spine. All the species occur in South Africa, Cape Province; *A. recognitus* also occurs in the Orange Free State and *A. rotundipennis* and *A. bicoloritarsis*, which both have a strictly coastal distribution, also occur in Natal and the latter also in Mozambique. Three species also have a coastal distribution: *A. longicornis*, *A. hanstroemi* and *A. bicoloricornis*.

### Key to the species of Section 7

1 Connecting membrane of aedeagus with ventral sclerotization near attachment to median lobe .......... 2
— Connecting membrane of aedeagus without ventral sclerotizations .......... 3
2 Ventral sclerotization of connecting membrane in the form of a short V (Figs 231 and 232) .......... *bicoloritarsis*
— Ventral sclerotization of connecting membrane forms a pair of irregular structures (Fig. 233) .......... *colletti*

3 Ventral spine of median lobe of aedeagus pointing proximally almost parallel to shaft of median lobe .......... 4
— Ventral spine of median lobe of aedeagus pointing transversely or distally .......... 6
4 Connecting membrane of aedeagus with 32–40 teeth; genital opening of male with beaded margin and with 5–6 spines on each side (Fig. 239) .......... *reverendus*
— Connecting membrane of aedeagus with 27–28 teeth .......... 5
5 Elytra dark with two pairs of light maculae, the anterior pair may be unclear (Fig. 240); male genital opening with beaded margin and on either side a row of about seven saw-like teeth (Fig. 238) .......... tumefactus
— Elytra light testaceous with two incomplete dark bands (Fig. 244); spiculum gastrale with apical area in the form of a lightly sclerotized isosceles triangle (Fig. 246) .......... *longicornis*
6 Elytra dark with light shoulder macula and pair of round maculae on posterior half; connecting membrane of aedeagus with about 35 teeth (Figs. 247 and 248) .... *recognitus*
— No shoulder maculae on elytra .......... 7
7 Median lobe of aedeagus straight and slender but with broad dark base (Figs 253 and 254) .......... *rotundipennis*
— Median lobe of aedeagus without dark broad base .......... 8
8 Sternum of retracted abdominal segment of male consisting of a pair of sclerites each ending in three dark points; elytra dark with pair of light maculae on posterior half (Fig. 257) .......... *bradfordi*
— Sternum of retracted abdominal segment of male without dark points. .......... 9
9 Ventral spine of median lobe of aedeagus pointing transversely (Fig. 262) ... *hanstroemi*
— Ventral spine of median lobe of aedeagus pointing obliquely distally (Fig. 268) .......... *bicoloricornis*

*Anthicus (Aulacoderus) bicoloritarsis* Pic, Figs 231–232

*Anthicus (Aulacoderus) bicoloritarsis* Pic, 1948, 15.

Size. Length 1,91 mm (1,75–2,05); width over broadest part of elytra 0,82 mm (0,75–0,90).

*Head.* Glossy, black; posterior arch broadly transverse, diverging to eyes, strongly narrowing from eyes to mouthparts; distinctly punctured, with fine grey procumbent hairs. Eyes large and bulging.

*Prothorax.* Glossy, very dark testaceous to black; broader than long, narrower than head; shoulders round and broad; with two pairs of erect lateral hairs, anterior pair on shoulders, posterior pair half-way between shoulders and base; punctures closer than on head but scarce on basal area, with short grey recumbent hairs; lateral constrictions not prominent but marked by long lateral hairs and connected by dorsal transverse groove at $\frac{5}{6}$ of the length of the prothorax.

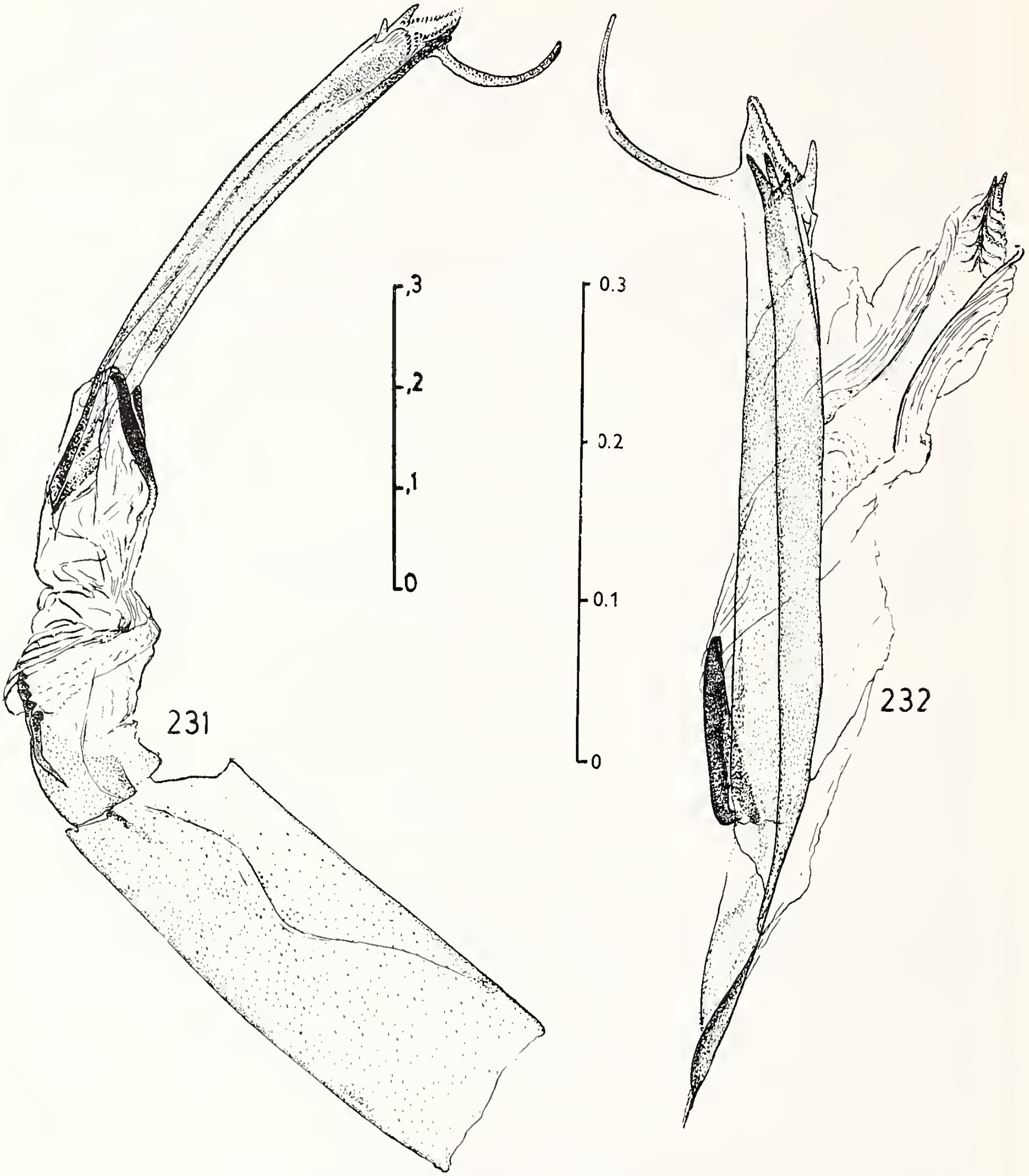
*Elytra.* Glossy, very dark testaceous to black; elongate in male with shoulders and pointed apex; in female without shoulders and apically obliquely truncate; punctures more widely spaced than on prothorax with fine recumbent hairs and a number of erect hairs, especially along lateral margins.

*Wings.* Fully developed in male, reduced in female.

*Antennae.* testaceous, first proximal and apical 5–6 segments darker; apical 3–4 segments broader; last segment almost as long as two preceding ones together.

*Legs.* Testaceous, coxae, distal half of femora and two apical tarsal segments darker.

*Undersurface.* Dark testaceous to black; in female metasternum and mesepimerite apophyses shorter than in male.



Figs 231–232. *A.* (*A.*) *bicoloritarsis* Pic. 231: aedeagus everted. 232: aedeagus inverted, connecting membrane torn open.

*Male abdomen.* Aedeagus (Figs 231 and 232): median lobe with long curved distally pointing ventral spine; genital opening with beaded margin and three short spines at proximal end of genital opening; connecting membrane with row of about seven single teeth and V-shaped ventral sclerite near attachment of connecting membrane to base of median lobe. When aedeagus is in resting position (Fig. 232) the arms of the V point forwards but in everted position (Fig. 231) the V turns with the connecting membrane and arms are pointing backwards; in some specimens the arms of the V are not fused at base; this condition comes close to that of *A. colletti* (Fig. 233) where however sclerotization is more irregular; tegmen with basal piece almost five times as long as apical piece. Retracted segment: tergum almost semi-circular, with some apical hairs and basal transverse row of fenestrae; sternum consisting of two narrow plates. Last exposed sternum with round apex.

MATERIAL EXAMINED. South Africa: along the whole South African coast, various dates, many specimens, (J. C. van Hille) (AMSA). Mozambique: Delagoa Bay, Inhaca Island, xii.1954, 2 ♂♂, 4 ♀♀, (E. McC. Callan) (AMSA).

This species was described from material sent by the author to Pic from Plettenberg Bay 3423AB. Pic mentions that this species should be placed near *A. robusticeps* Pic (1903a), described from Natal. In the collection of the Natural History Museum, Vienna, are four specimens, three from Port St Johns 3129DA and one from Mossel Bay 3422AA, all labelled '*robusticeps* Pic, det. v. Krekich'; these specimens are all *A. bicoloritarsis* Pic. Judging from the description of *A. robusticeps* it seems likely that the two names are synonyms. Also it seems unlikely that such a common and widespread species should have been unnoticed till 1948. The younger name has been retained because, whereas type material of *A.* (*A*) *robusticeps* Pic was not available, the author has seen Paratypes of *A.* (*A.*) *bicoloritarsis* Pic.

In addition to the black specimens there occur specimens with one or two pairs of light maculae on the elytra; the anterior maculae are often vague or absent. In one locality specimens with and without maculae may be found together; maculae occur more frequently in males than in females. No specimens with maculae have been found east of Mossel Bay 3422AA.

*Anthicus (Aulacoderus) colletti* **spec. nov.,** Figs 233–235

Size. Length 2,18 mm (2,05–2,37); width over broadest part of elytra 0,76 mm (0,70–0,81).

*Head* (Fig. 234). Glossy, testaceous; elongate, posterior arch round; rather coarsely punctured, with light procumbent hairs. Eyes bulging.

*Prothorax* (Fig. 234). Glossy, testaceous; broader than long, slightly broader than head; shoulders sloping and round; punctures rather coarse and dense but reduced on posterior quarter; with fine light recumbent hairs; lateral constrictions inconspicuous, not very hairy, connected by a dorsal basal transverse groove.

*Elytra.* Glossy, testaceous; rather slender and elongate; punctures coarse, less dense than on prothorax with fine light recumbent hairs, slightly longer than on prothorax.

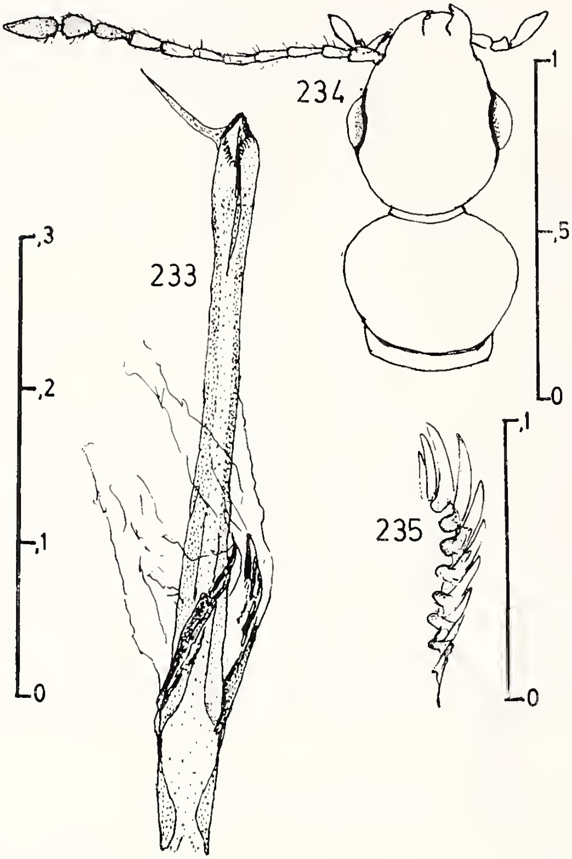
*Wings.* Fully developed in males; no females have been seen.

*Antennae.* Slender, testaceous; apical three segments darker and slightly broader; last segment shorter than two preceding ones together.

*Legs.* Testaceous.

*Undersurface.* Testaceous.

*Male abdomen.* Aedeagus: median lobe (Fig. 233) slender and simple, with terminal diamond-shaped genital opening with finely beaded margin, with straight backwards pointing ventral spine; connecting membrane with dorsal row of about 10 single teeth (Fig. 235); with somewhat irregular paired sclerotizations at ventral attachment to base of median lobe; tegmen



Figs 233–235. *A.* (*A.*) *colletti* spec. nov. 233: median lobe of aedeagus with part of connecting membrane. 234: head and prothorax. 235: dorsal row of teeth of connecting membrane of aedeagus.

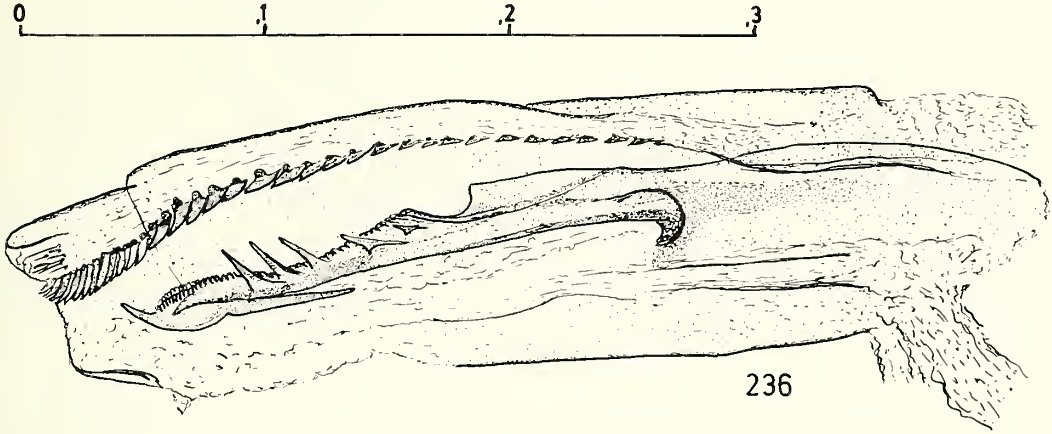
with basal piece three to four times as long as apical piece. Retracted segment: tergum apically round and hairy, with basal transverse row of fenestrae; sternum consisting of a pair of thin elongate plates. Last exposed sternum broadly triangular with somewhat rounded apex.

Material examined. South Africa: Keurbooms River Mouth [3322DD], xii.1948, Holotype ♂, (W. E. Collett) (AMSA); Sedgefield, Groenvlei, Lake Pleasant [3422BB], to meloid bait, 14.xii.1977, Paratypes 4 ♂♂, (J. C. van Hille) (AMSA).

*Anthicus (Aulacoderus) reverendus* Pic, Fig. 236
*Anthicus (Aulacoderus) reverendus* Pic, 1903d, 180

Size. Length 2,44 mm (2,21–2,69); width over broadest part of elytra 0,81 mm (0,70–0,92).

*Head.* Glossy, dark testaceous to black; posterior arch broadly round; punctures fine with fine dark procumbent hairs. Eyes slightly bulging.



Figs 236. *A.* (*A.*) *reverendus* Pic. 236: aedeagus.

*Prothorax*. Glossy, dark testaceous but lighter at base; longer than broad, narrower than head; shoulders sloping and round; punctures fine, scarce on posterior quarter, with fine dark recumbent hairs; lateral constrictions at $\frac{3}{4}$ of the length of the prothorax with fine short hairs; without transverse basal groove.

*Elytra*. Somewhat glossy, dark testaceous with two pairs of lighter maculae which may reach lateral margins but not median suture; punctures larger than on prothorax with dark recumbent hairs, but on maculae hairs are light; anterior maculae may be indistinct or even absent but even then hairs are light in this area.

*Wings*. Fully developed.

*Antennae*. Testaceous, last three segments darker and somewhat broader; last segment not quite as long as two preceding ones together.

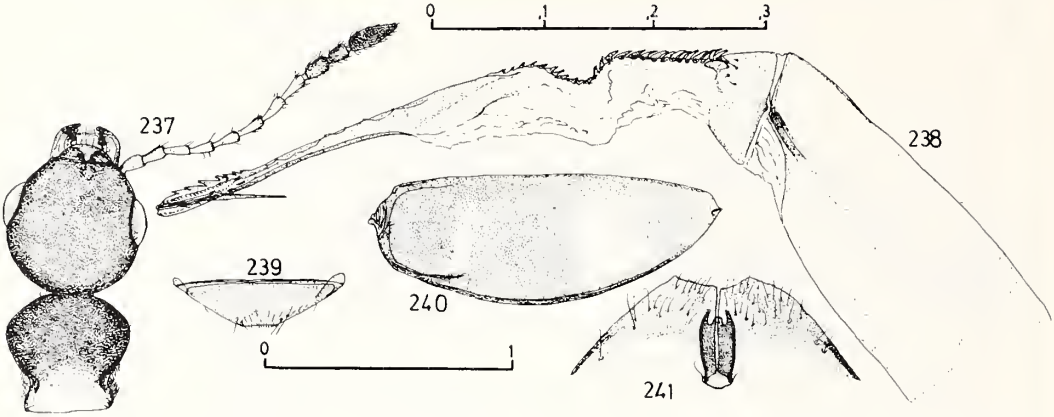
*Legs*. Testaceous, coxae and femora, especially distal part, somewhat darker.

*Undersurface*. Dark testaceous, abdomen darker than thorax.

*Male abdomen*. Aedeagus (Fig. 236): median lobe: apex pointed and turned up dorsally; with ventral proximally pointing spine, parallel to shaft of median lobe; genital opening subapical and elongate, with beaded margin and on each side 5–6 distally pointing spines, decreasing in length from apex to base; with dorsal excavation immediately proximal to genital opening; this excavation is only visible when median lobe is seen in profile; connecting membrane with dorsal row of about 32–40 single teeth; tegmen with basal piece five times as long as apical piece. Retracted segment: tergum with apical region dark, with dark transverse line; more proximal a transverse row of fenestrae; sternum consisting of pair of narrow sclerites of which only proximal margin is well sclerotized. Last exposed sternum with flat apex.

MATERIAL EXAMINED. South Africa: Montagu [3320CC], x.1924, 1 ♂, Krekich det., (R. E. Turner) (NMW); Oudtshoorn [3322CA], 15–16.ix.1938, 1 ♂, (D. L. Uyttenboogaart) (ITZA); Worcester [3319CB], ix.1928, 1 ♂, (R. E. Turner) (BMNH); Willowmore [3319CB], x.1910, 1 ♂, xi.1914, 1 ♂, undated, 3 ♂♂, (Dr Brauns) (AMSA); Prince Albert [3322AA], to meloid bait, 25.ix,1953, 6 ♂♂, (J. C. van Hille) (AMSA).

In one of the Willowmore specimens the gut is full of pollen.



Figs 237–241. *A.* (*A.*) *tumefactus* Pic. 237: head an prothorax. 238: aedeagus. 239: last exposed abdominal sternum of male. 240: elytron of male. 241: apex of last exposed abdominal tergum of female.

*Anthicus (Aulacoderus) tumefactus* Pic, Figs 237–241
*Anthicus (Aulacoderus) tumefactus* Pic, 1901, 100
*Anthicus (Aulacoderus) middletoniensis* van Hille, 1961, 244

Size. Length 2,48 mm (2,15–2,72); width over broadest part of elytra 0,85 mm (0,80–0,92).

*Head* (Fig. 237). Glossy, very dark testaceous to black; posterior arch round; closely punctured with short procumbent hairs. Eyes slightly bulging.

*Prothorax* (Fig. 237). Very dark testaceous to black but posterior area testaceous; slightly broader than long, narrower than head; shoulders sloping and round; behind shoulders narrowing to well developed hairy lateral constrictions; punctures distinct and close, but indistinct on posterior quarter; hairs fine and recumbent.

*Elytra* (Fig. 240). Convex, glossy, very dark testaceous to black with two pairs of light maculae; anterior pair transverse, narrow and indistinct, posterior pair distinct and round; neither pair reaches median suture; punctures fine, less dense than on prothorax; hairs dark and recumbent but lighter finer and shorter on maculae.

*Wings*. Fully developed.

*Antennae* (Fig. 237). slender, testaceous, last three segments darker and slightly broader; last segment as long as two preceding ones together.

*Legs*. Testaceous, coxae and femora darker.

*Undersurface*. Dark testaceous.

*Male abdomen*. Aedeagus (Fig. 238): median lobe with subapical proximally pointing ventral spine; genital opening apical and elongate with beaded margin; lateral to genital opening a row of about seven saw-tooth spines on each side; connecting membrane with about 27 single teeth; tegmen with basal piece five times as long as apical piece. Retracted segment: tergum with dark apical region with some apical hairs and transverse uninterrupted row of fenestrae; sternum consisting of a pair of thin narrow plates. Last exposed sternum (Fig. 239) with flat apex.

*Female abdomen*. Last exposed tergum (Fig. 241) with deep narrow apical slit, its proximal part covered by a dark duplication of integument.

MATERIAL EXAMINED. South Africa: Dunbrody [3325BC], 29.ix.1900, Type 1 ♀, (Fr O'Neil) (MNHN); Mossel Bay [3422AA], xi–xii.1931, 4 ♂♂, 1 ♀, (R. E. Turner) (BMNH); Mossel Bay [3422AA], 8–9.i.1951,2 ♂♂, (Brinck & Rudebeck) (UEML); 15 miles south of Middleton [3326AB], 16.i.1951, 3 ♂♂, (Brinck & Rudebeck) (UEML 1 ♂, AMSA 1 ♂, SAM 1 ♂); Cape, Karroo, Farm Zwartskraal 33.10S–22.32E, groundtraps with faeces bait, 1671a, 5 ♂♂, (R. Oosthuizen) (TMP).

The specimens collected by the Swedish expedition of Brinck and Rudebeck were described as *A.* (*A.*) *middletoniensis* van Hille (1961). With more material available and a more successful preparation of the aedeagus it was found that the median lobe of the aedeagus has a fine subapical spine which is invisible when the median lobe is mounted dorso-ventrally. It was also found that the connecting membrane has as many as 27 teeth. By comparison with the type from the museum in Paris the correct name could be established.

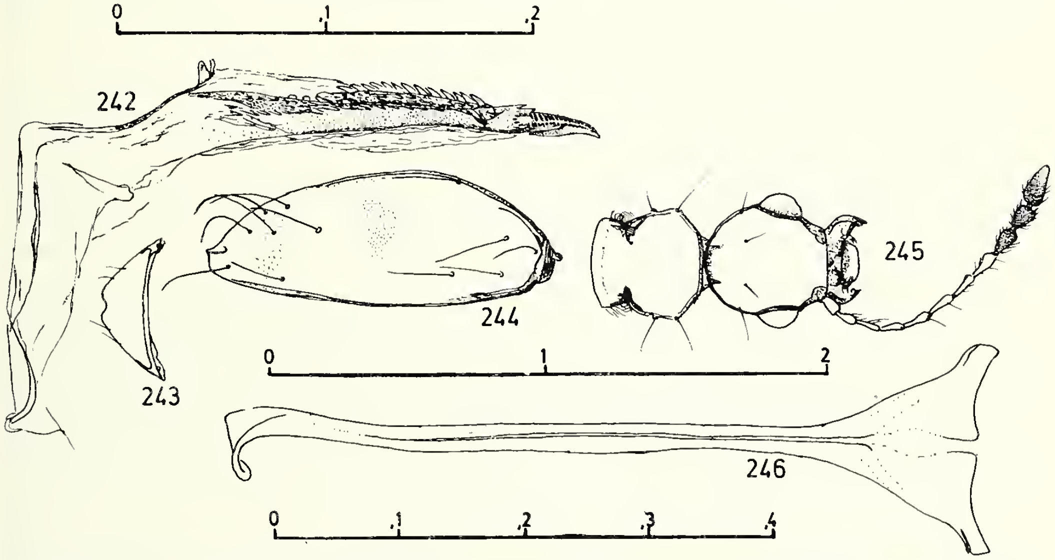
*Anthicus (Aulacoderus) longicornis* **spec. nov.**, Figs 242–246

Size. Length 1,89 mm (1,87–1,90); width over broadest part of elytra 0,96 mm (0,94–0,98).

*Head* (Fig. 245). Glossy, light testaceous; posterior arch round; punctures rather coarse with fine short procumbent hairs; a pair of long erect lateral hairs behind eyes and another pair dorsally on posterior half. Eyes large and bulging.

*Prothorax* (Fig. 245). Somewhat glossy, light testaceous; as long as broad, narrower than head; shoulders angular, each with a long erect lateral hair; a similar pair of erect lateral hairs behind shoulders; lateral constrictions at $\frac{2}{3}$ of the length of the prothorax, each with a transverse, inwards pointing apophysis with spiral markings; punctures coarser than on head but absent on posterior quarter; hairs fine short and recumbent.

*Elytra* (Fig. 244). Glossy, light testaceous, each with somewhat darker areas in the middle



Figs 242–246. *A.* (*A.*) *longicornis* spec. nov. 242: aedeagus. 243: last exposed abdominal sternum of male. 244: elytron of male. 245: head and prothorax. 246: spiculum gastrale of male.

and subapically; punctures coarser and more widely spaced than on prothorax; with fine recumbent hairs, longer than on prothorax; with a number of very long semi-erect hairs.

*Wings*. Reduced, shorter than elytra.

*Antennae* (Fig. 245). Light testaceous; long and very slender; three apical segments broader and almost black; last segment shorter than two preceding ones together.

*Legs*. Light testaceous.

*Undersurface*. Light testaceous.

*Male abdomen*. Aedeagus (Fig. 242): median lobe with apical proximally pointing ventral spine and apical genital opening with beaded margin; connecting membrane with about 28 teeth of which those near the attachment to the median lobe have additional side teeth; tegmen membranous, differentiation in apical and basal piece indistinct. Spiculum gastrale (Fig. 246) long and little sclerotized, without apical Y-arms but ending in an isosceles triangle. Retracted segment: tergum narrow, with round apex, with dark transverse line and parallel more proximal row of fenestrae; sternum consisting of pair of narrow little sclerotized plates. Last exposed sternum (Fig. 243) with small apical indentation.

MATERIAL EXAMINED. South Africa: Port St Johns [3124DA], i–v.1924, Holotype ♂, Paratypes 2 ♂♂, (R. E. Turner) (BMNH).

*Anthicus (Aulacoderus) recognitus* Pic, Figs 247–252
*Anthicus (Aulacoderus) recognitus* Pic, 1903d, 180

Size. Length 2,53 mm (2,27–2,68); width over broadest part of elytra 0,99 mm (0,87–1,01).

*Head*. Glossy, dark testaceous to black; posterior arch broad, with round angles, each with an erect lateral hair; punctures very fine with procumbent hairs. Eyes not much bulging.

*Prothorax*. Glossy, slightly lighter than head, posteriorior quarter much lighter; somewhat broader than long, slightly narrower than head; shoulders sloping, somewhat angular; with two pairs of lateral erect hairs; basal constrictions well developed with long hairs; punctures coarser than on head with dark recumbent hairs.

*Elytra* (Fig. 247). Glossy, dark testaceous with light testaceous macula on shoulder and round macula on posterior half; maculae not always distinct, especially not in females (see below); punctures as on prothorax with dark recumbent hairs but light on areas of maculae, also when maculae are unclear or absent; with a number of erect and semi-erect hairs.

*Wings*. Fully developed or reduced.

*Antennae*. Testaceous but first proximal and apical three segments darker, the latter somewhat broader; last segment as long as two preceding ones together in male, shorter in female.

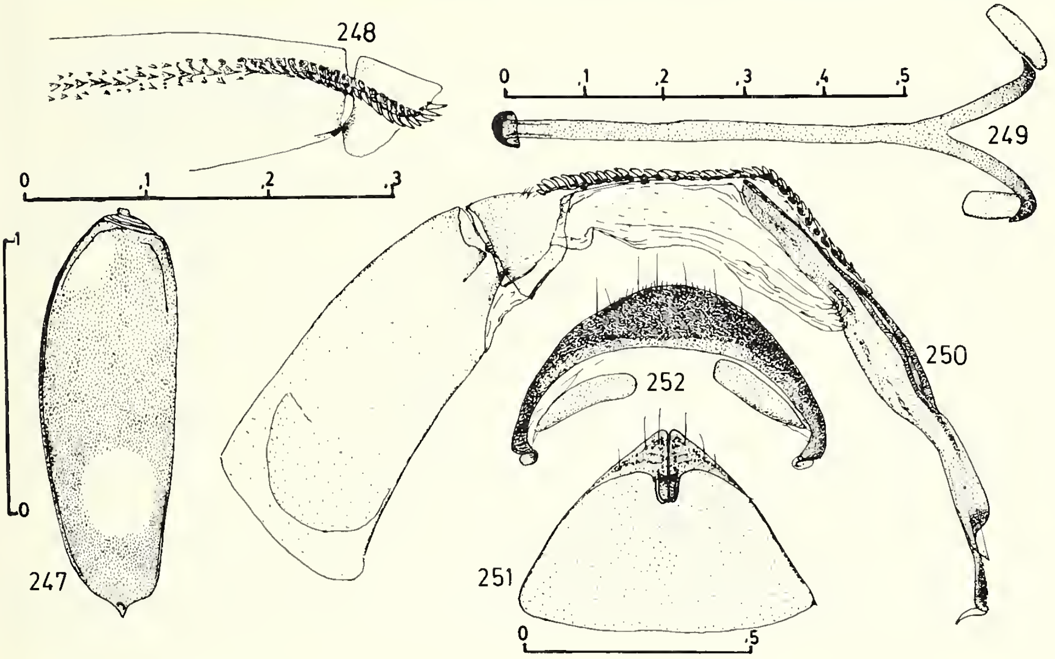
*Legs*. Testaceous, coxae, femora and last two tarsal segments darker.

*Undersurface*. Testaceous to dark testaceous.

*Male abdomen*. Aedeagus (Fig. 250): median lobe narrow, elongate and somewhat sinuous, with short apical ventral spine and elongate genital opening with beaded margin; connecting membrane with about 35 dorsal teeth, teeth nearest to attachment to base of median lobe accompanied by somewhat irregular lateral teeth; tegmen slightly sclerotized, basal piece about three times as long as apical piece (Fig. 248). Retracted segment (Fig. 252): tergum with round apex; apical area darker than proximal area, separated by transverse row of fenestrae; sternum consisting of pair of small thin plates. Spiculum gastrale (Fig. 249) Y-shaped with rectangular extraspicular sclerites with round angles. Last exposed sternum flat at apex.

*Female abdomen*. Last exposed tergum (Fig. 251) apically divided in two, the division ending in narrow cup-like structure.

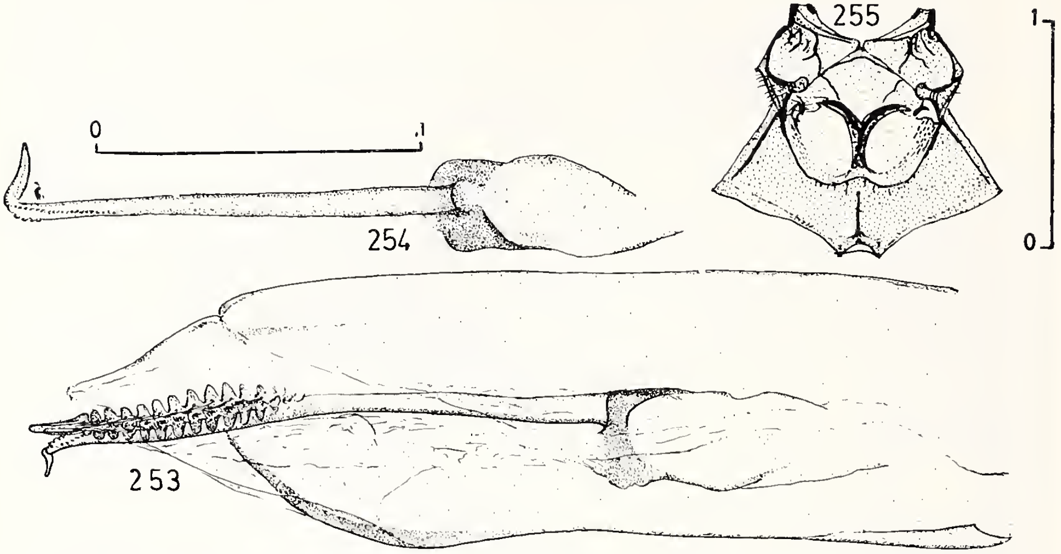
MATERIAL EXAMINED. South Africa: Willowmore [3323AD], 1902, 3 ♂♂, (Dr H. Brauns) (AMSA); Kimberley [2824DB], 5.v.1946, 1 ♂, (R. J. B. Power) (AMSA); Grahamstown,



Figs 247–252. *A.* (*A.*) *recognitus* Pic. 247: elytron of male. 248: tegmen and connecting membrane with teeth of aedeagus. 249: spiculum gastrale with extra-spicular sclerites of male. 250: aedeagus. 251: last exposed abdominal tergum of female. 252: retracted abdominal segment of male.

Palmiet River [3326BB], 27.vii.1947, 2 ♂♂, (J. C. van Hille) (AMSA); Pluto's Vale [3326DB], 28.iii.1948 and 28.ii.1979, 3 ♂♂, 1 ♀ (J. C. van Hille) (AMSA); Grahamstown, Fort Brown [3326BA], 3.vii.1948, 4 ♀♀, (J. C. van Hille) (AMSA); Grahamstown, Cradock Road [3326BC], in flowers of *Cryophytum angulare, Psilocaulon* sp. and *Cryptostemma calendaceum*, 21.iv.1951, 3 ♂♂, 55♀♀ (J. C. van Hille) (AMSA); Fort Beaufort, Dan's Hoogte [3226DC], to meloid bait, 19.iii.1970, 28 ♂♂, (J. C. van Hille) (AMSA); Bethulie, Game Park 'Tussen die Riviere' [3025BD], to meloid bait, iv.1979, 16 ♂♂, (J. C. van Hille) (AMSA).

The original description is probably based on female specimens as Pic (1903d) describes the elytra as 'obliquement tronquées au sommet' which does not apply to males where the pointed elytral apex is prominent (Fig. 247). Pic mentions the shoulder macula of the elytron and also that the apical region of the elytron may be vaguely coloured in a similar way. In 1938 Pic described *A.* (*A.*) *recognitus* v. nov. *submaculosus* which has the posterior macula. In the collection made in 1951 (Grahamstown, Cradock Road) the three males all have a distinct posterior macula which is absent in the 55 females. When the elytron of the female is seen in transmitted light there is a somewhat lighter area in the apical region which does not show under incident light. In this area the hairs are light. The author has not seen a male where the posterior macula is absent, nor a female where it is distinct. As the occurrence of the posterior macula seems to be a sexual rather than a systematic feature the variety *submaculosus* Pic should fall away.



Figs 253–255. *A.* (*A.*) *rotundipennis* Pic. 253: aedeagus. 254: median lobe of aedeagus. 255: meso- and meta-thoracic sterna.

*Anthicus (Aulacoderus) rotundipennis* Pic, Figs 253–255
*Anthicus (Aulacoderus) rotundipennis* Pic, 1895a: 43
*Anthicus (Aulacoderus) subrotundipennis* Pic, 1948: 14

Size. Length 1,75 mm (1,60–1,85); width over broadest part of elytra 0,72 mm (0,65–0,80).

*Head*. Glossy, testaceous to dark testaceous, colour variable; posterior arch broadly round; distinctly punctured, with procumbent hairs. Eyes rather small, bulging.

*Prothorax*. Glossy, testaceous to dark testaceous, often lighter than head; broader than long, broader than head; shoulders round with two pairs of erect lateral hairs and some more on dorsal surface; punctures as on head with fine recumbent hairs, sparser on posterior quarter; lateral constrictions inconspicuous with few hairs, connected by a basal dorsal transverse groove.

*Elytra*. Glossy, testaceous to dark testaceous, variable in colour and shape; length over width of elytron varying between 2,38 and 3,26; punctures less dense and recumbent hairs longer than on prothorax; with some erect hairs. Male with small apical point, notch hardly visible.

*Wings*. Reduced.

*Antennae*. Not slender; apical four to five segments gradually broader and somewhat darker; last segment one and a half times as long as preceding one.

*Legs*. Testaceous.

*Undersurface*. Testaceous to dark testaceous; abdomen darker than thorax; metasternum (Fig. 255) short and broad.

*Male abdomen*. Aedeagus (Fig. 253): median lobe (Fig. 254) with short apical ventral spine and elongate genital opening with finely beaded margin; proximally sharply widening to form a dark broader base; connecting membrane with about 15 dorsal teeth; tegmen little sclerotized, basal piece five times as long as apical piece. Retracted segment: tergum semicircular with irregular transverse dark line and more proximal row of fenestrae; sternum consisting of a pair of hardly sclerotized plates, each with an apical hair. Spiculum gastrale short and sturdy with strongly diverging Y-arms. Last exposed sternum with round apex.

Material examined. South Africa: Boknes [3326DA], Port Alfred [3326DB], Kleinemonde [3327CA], Mpequeni [3327AD], Christmas Rock [3327BA], at various dates, many specimens, (J. C. van Hille) (AMSA); Sibaya [2732BC], i.1967, 10 ♂♂, (J. C. van Hille) (AMSA).

The author has seen a female type of *A.* (*A.*) *subrotundipennis* Pic (1948) (MNHN). It was collected by the author and sent to M. Pic. In the author's collection (AMSA) are a number of specimens belonging to the same series. The author cannot find a difference from *A.* (*A.*) *rotundipennis* Pic (1895a) and concludes that the species *A.* (*A.*) *subrotundipennis* Pic should be sunk being a synonym.

*Anthicus (Aulacoderus) bradfordi* **spec. nov.**, figs 256–258

Size. Length 1,76 mm (1,50–1,96); width over broadest part of elytra 0,65 mm (0,52–0,85)

*Head* (Fig. 258). Highly glossy, black; posterior arch transversely straight with round angles towards eyes; punctures distinct with short semi-procumbent hairs pointing obliquely to median line. Eyes somewhat bulging.

*Prothorax* (Fig. 258). Glossy, very dark testaceous to black, posterior margin testaceous; broader than long, as broad as head; shoulders round; punctures distinct, but scarce on posterior margin, with recumbent hairs, longer and denser than on head, and with a number of erect hairs; lateral constrictions not very hairy, connected by dorsal transverse groove.

*Elytra*. Somewhat glossy, black with pale testaceous pair of maculae at apical third; shoulders well developed; with dark recumbent hairs longer than on prothorax but on maculae and on an area in front of middle the hairs are finer and lighter; also a number of erect hairs.

*Wings*. Fully developed.

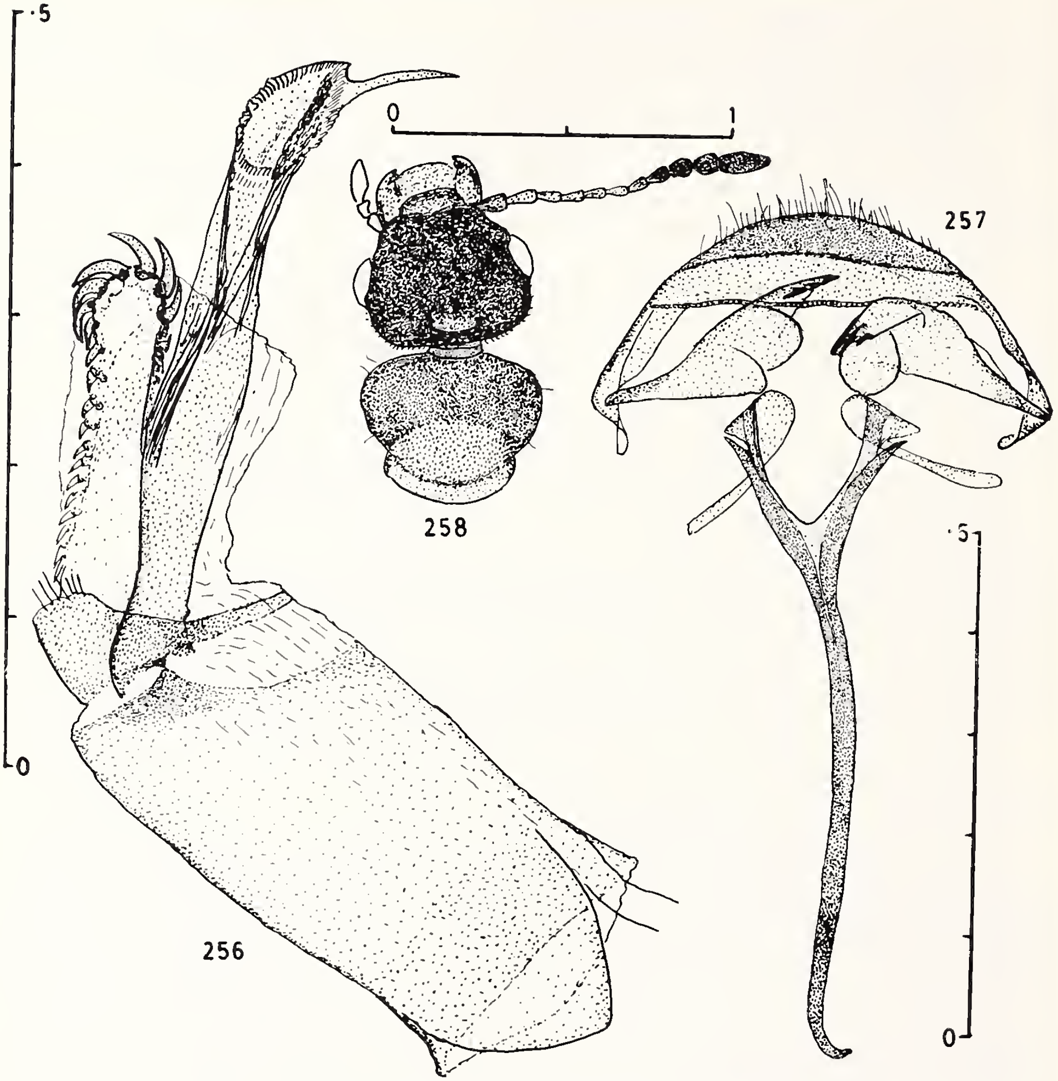
*Antennae*. Testaceous to dark testaceous; apical 4–5 segments darker, but hardly broader; last segment as long as two preceding ones together (Fig. 258).

*Legs*. Testaceous; coxae, femora and apical two segments of tarsi dark testaceous.

*Undersurface*. Dark testaceous to black with recumbent hairs.

*Male abdomen*. Aedeagus (Fig. 256): median lobe with apical ventral spine and widely open oval genital opening with beaded margin; connecting membrane with dorsal row of 16–19 single teeth; tegmen with basal piece about five times as long as apical piece. Retracted segment (Fig. 257): tergum with proximal row of fenestrae; in some specimens a more distal dark transverse line but in other specimens this is not visible; sternum consisting of a pair of sclerites each ending in three dark points. Spiculum gastrale (Fig. 257): each of the Y-arms shortly forked at apex, the lateral branch thinner and shorter than the median branch; extraspicular sclerites broad at base ending in a narrow elongate strand pointing outwards. Last exposed sternum apically flat or shortly incised.

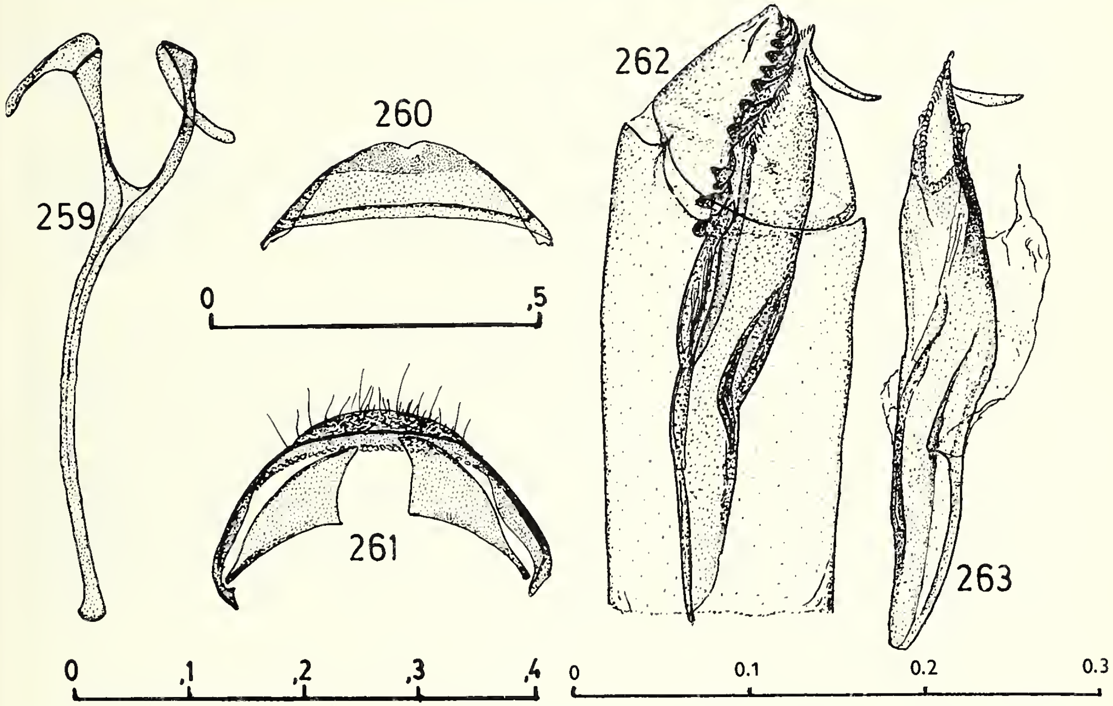
Material examined. South Africa: Oudtshoorn [3322CA], 24.ix.1953, Holotype ♂, Paratypes 4 ♂♂, (J. C. van Hille) (AMSA); Kenton on Sea [3326DA], x.1947, Paratypes 2 ♂♂, (B. F. Bradford) (AMSA); Grahamstown, Rhodes University Grounds [3326BC], x.1952, Paratypes 2 ♂♂, (J. C. van Hille) (AMSA); Somerset East [3225DA], x-xi.1935, Paratypes 2 ♂♂, (R. E. Turner) (BMNH); Mossel Bay [3422AA], x.1921 and 2.xii.1938, 2 ♂♂, (R. E. Turner) (BMNH); Kleinemonde [3326DB], i.1954, Paratypes 2 ♂♂, (J. C. van Hille) (AMSA); Knysna [3423AA], 10.ii.1970, Paratypes 2 ♂ ♂, (J. C. van Hille) (AMSA); Sundays River Mouth [3325DB], 20.ix.1953, to meloid bait, Paratypes 13 ♂♂, (J. C. van Hille,



Figs 256–258 *A.* (*A.*) *bradfordi* spec. nov. 256: aedeagus, partly everted. 257: retracted abdominal segment and spiculum gastrale of male. 258: head and prothorax.

(AMSA); Prince Albert [3321DC], 25.ix.1953, Paratypes 2 ♂♂, (J. C. van Hille) (AMSA); The Wilderness [3322DC], 10.ii.1970, Paratype 1 ♂, (J. C. van Hille) (AMSA); Cape Point Nature Reserve [3418AD], 10.xii.1950, 2 ♂♂ (Brinck & Rudebeck) (UELM).

The last two specimens have been described (van Hille 1961) as possible variations of *A.* (*A.*) *hanstroemi* van Hille (1961). Thanks to more material it could be decided that they are a separate species.



Figs 259–263. *A.* (*A.*) *hanstroemi* van Hille. 259: spiculum gastrale with extra-spicular sclerites of male. 260: last exposed abdominal sternum of male. 261: retracted abdominal segment of male. 262: aedeagus. 263: median lobe of aedeagus.

*Anthicus (Aulacoderus) hanstroemi* van Hille, Figs 259–263
*Anthicus (Aulacoderus) hanstroemi* van Hille, 1961: 248–249

Size. Length 1,58 mm (1,44–1,70); width over broadest part of elytra 0,65 mm (0,58–0,75).

*Head.* Glossy, black; posterior arch almost straightly transverse, with rounded angles towards eyes; with distinct punctures with short grey procumbent hairs. Eyes slightly bulging.

*Prothorax.* Somewhat glossy, dark testaceous but lighter than head; broader than long, as broad as head; shoulders sloping and round; lateral constrictions not prominent, connected by fine transverse dorsal groove; punctures distinct with grey recumbent hairs.

*Elytra.* Somewhat glossy, dark testaceous; elongate with distinct shoulders; punctures finer than on prothorax with grey recumbent hairs.

*Wings.* Fully developed.

*Antennae.* Darkish testaceous, apical 4–5 segments darker and gradually broader; apical segment almost as long as two preceding ones together.

*Legs.* Testaceous; coxae, femora and two apical tarsal segments darker.

*Undersurface.* Dark testaceous to black.

*Male abdomen.* Aedeagus (Fig. 262): median lobe (Fig. 263) rather sturdy, with apical ventral spine and oval genital opening with beaded margin; connecting membrane with 10–11 single dorsal teeth; tegmen with basal piece twice as long as apical piece. Retracted segment (Fig. 261): tergum semicircular with round apex, dark transverse subapical line and more proximal transverse row of fenestrae; sternum consisting of pair of broad triangular plates. Spiculum gastrale (Fig. 259) rather short with a pair of slender extra-spicular sclerites. Last exposed sternum (Fig. 260) with small apical indentation.

Material examined. South Africa: Cape Point Nature Reserve [3418AD], 10.xii.1950, Holotype ♂, Paratypes 5 ♂♂, 3 ♀♀, (Brinck & Rudebeck) (UELM); Langebaan [3318AA], 31.x.1950, Paratypes 2 ♂♂, (Brinck & Rudebeck) (UELM).

*Anthicus (Aulacoderus) bicoloricornis* Pic, Figs 264–270

*Anthicus (Aulacoderus) bicoloricornis* Pic, 1948: 15

Size. Length 1,54 mm (1,45–1,58); width over broadest part of elytra 0,56 mm (0,50–0,60).

*Head* (Fig. 266). Glossy, reddish testaceous; posterior arch round to broadly round; punctures close with fine procumbent hairs. Eyes rather small, somewhat bulging.

*Prothorax* (Fig. 226). Glossy, reddish testaceous; broader than long, narrower than head; shoulders sloping and round; punctures distinct, as dense as on head but absent on posterior quarter; with fine recumbent hairs; lateral constrictions with few short hairs, connected by a transverse basal dorsal groove.

*Elytra* (Fig. 267). Light testaceous to testaceous, rather elongate with distinct round shoulders; punctures less dense than on prothorax, with recumbent hairs and some erect hairs along lateral margins and on apical area.

*Wings*. Fully developed or reduced.

*Antennae* (Fig. 266). Slender, testaceous, apical 3–4 segments dark and slightly broader; last segment one and a half times as long as penultimate segment.

*Legs*. Light testaceous.

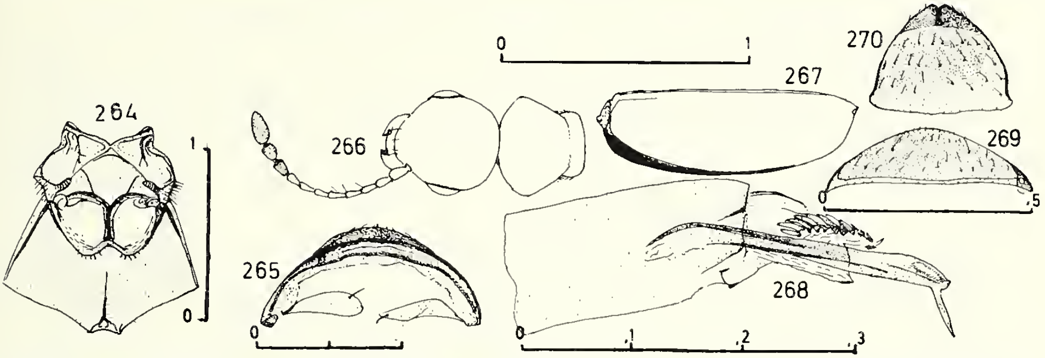
*Undersurface*. Testaceous.

*Male abdomen*. Aedeagus (Fig. 268): median lobe straight; apically pointed, gradually widening to base; with subapical straight ventral spine pointing obliquely and distally; connecting membrane with about 11 single dorsal teeth; tegmen lightly sclerotized, basal piece three times as long as apical piece. Retracted segment (Fig. 265): tergum semi-circular with distinct dark transverse line and more proximal transverse row of fenestrae; sternum consisting of a pair of hardly sclerotized curved plates, each with a single hair. Spiculum gastrale thin, not or hardly pigmented, with short Y-arms. Last exposed sternum (Fig. 269) with bluntly rounded apex.

*Female abdomen*. Last exposed sternum (Fig. 270) with short apical slit.

Material examined. South Africa: Simonstown [3418AB], iv.1915, 2 ♂♂, 3 ♀♀, (Dr M. Cameron) (BMNH); Mossel Bay [3422AA], iv.1921, 2 ♂♂, (R. E. Turner) (BMNH); same locality ii.1922, 10 ♂♂, 2 ♀♀, (R. E. Turner) (BMNH); same locality vii.1924, 1 ♂, (R. E. Turner) (BMNH); same locality vi–vii.1930, 2 ♀♀, (R. E. Turner) (BMNH); same locality viii.1932, 2 ♂♂, (R. E. Turner) (BMNH); Kleinemonde [3326DB], Port Alfred [3326DB], Kasouga [3326DA], Boknes [3326DA], various dates, many specimens, (J. C. van Hille) (AMSA); between Muizenberg and Strand [3418AB], sand dunes 1 mile inland, 3 ♂♂, 1 ♀, (V. B. Whitehead) (AMSA); Cape Town [3318CD], no date, 1 ♂, (A. F. J. Gedye) (BMNH).

The last specimen is labelled '*Aulacoderus boviei* Pic? det. Krekich'. *A. (A.) boviei* Pic is described from Zaire. It is unlikely that its distribution should stretch to Cape Town; moreover the species of *Aulacoderus* with a ventral spine on the median lobe are limited to Southern Africa, as far as is known. Krekich is right in doubting his identification.



Figs 264–270. *A.* (*A.*) *bicoloricornis* Pic. 264: meso- and metathoracic sterna. 265: retracted abdominal segment of male. 266: head and prothorax. 267: elytron of male. 268: aedeagus. 269: last exposed abdominal sternum of male. 270: last exposed abdominal tergum of female.

This species is easily confused with *A. (A.) rotundipennis* Pic. The two species have an overlapping coastal distribution and are both variable in colour. *A. (A.) bicoloricornis* is usually shorter and narrower and lighter in colour than *A. (A.) rotundipennis*. The aedeagus of the two species is different and in *A. (A.) bicoloricornis* the metathorax (Fig. 264) is longer and narrower than in *A. (A.) rotundipennis* (Fig. 255).

## SECTION 8

The species of this section are closely related to those of Section 7, but the ventral spine of the median lobe of the aedeagus is not a simple spike but is either a broader and more shaped structure or it is a more complicated one with sidebranches.

All the species of this section have a coastal habitat. All occur in South Africa except *A. (A.) hendeli* which was collected on the south coast of Tanzania and Kenya. *A. (A.) perlucidus* extends into southern Mozambique.

### Key to the species of Section 8

1 Ventral spine of median lobe of aedeagus is apically attached and is forked three times (Fig. 271) .................................................. *dorsalis*
— Ventral spine of median lobe of aedeagus is subapically attached .................. 2
2 Ventral spine of median lobe of aedeagus is attached distally to the genital opening 3
— Ventral spine of median lobe of aedeagus is not attached distally to the genital opening .................................................................... 4
3 Median lobe of aedeagus with two pairs of distally pointing dorsal spines, one pair at proximal end of the genital opening, the other pair at the distal end; in addition proximal to the genital opening a pair of lateral rows of 10 proximally pointing spines (Fig. 272) .................................................. *perlucidus*
— Median lobe of aedeagus with a row of about 11 distally pointing spines on either side of genital opening (Fig. 277) ........................................ *hendeli*
4 Median lobe of aedeagus with ventral spine attached opposite the genital opening (Fig. 278) .................................................. *amplus*
— Median lobe of aedeagus with ventral spine attached proximal to genital opening ... 5
5 Median lobe of aedeagus with long proximally pointing ventral spine with a short parallel spine at its base (Fig. 282) ..................................... *sibayensis*

— Median lobe of aedeagus with complicated branched ventral spine ................ 6

6 Connecting membrane of aedeagus with about 40 hardly sclerotized single dorsal teeth (Fig. 286) ........................................................ *bilineatus*

— Connecting membrane of aedeagus with about 28 well sclerotized dorsal teeth of which those nearest the attachment to the tegmen occur in transverse rows of three ................................................................ *albitarsis*

*Anthicus (Aulacoderus) dorsalis* Laf., Fig. 271

*Anthicus (Aulacoderus) dorsalis* La Ferté, 1848: 269–270

Size. Length 1,96 mm (1,77–2,27); width over broadest part of elytra 0,81 mm (0,69–0,90).

*Head.* Somewhat glossy, dark testaceous; posterior arch broadly round; punctures distinct with fine procumbent hairs and a pair of erect lateral hairs half-way between eyes and neck. Eyes hardly bulging.

*Prothorax.* Hardly glossy, testaceous but lighter at base; shoulders sloping and angular; broader than long, as broad as head; punctures distinct, reduced at base, with fine recumbent hairs; with two pairs of lateral erect hairs; lateral constrictions at $\frac{2}{3}$ of the length of prothorax, with fine short hairs.

*Elytra.* Mat, lighter than prothorax; with dark transverse band in the middle which in some specimens does not reach lateral margins; less distinct dark markings may occur along median suture at base and apex; punctures distinct, with fine recumbent hairs and a number of longer erect hairs.

*Wings.* Fully developed.

*Antennae.* Light testaceous, apical three segments broader and dark testaceous to black; last segment as long as two preceding ones together.

*Legs.* Light testaceous.

*Undersurface.* Dark testaceous, mesosternum lighter.

*Male abdomen.* Aedeagus: median lobe (Fig. 271) with branched apical ventral spine, elongated genital opening with beaded margin and proximal to genital opening a paired lateral group of 6–7 closely placed spines; connecting membrane with dorsal row of 17–19 single teeth; tegmen with basal piece three and a half times as long as apical piece. Retracted segment: tergum with transverse dark line and more proximal parallel row of fenestrae, widely

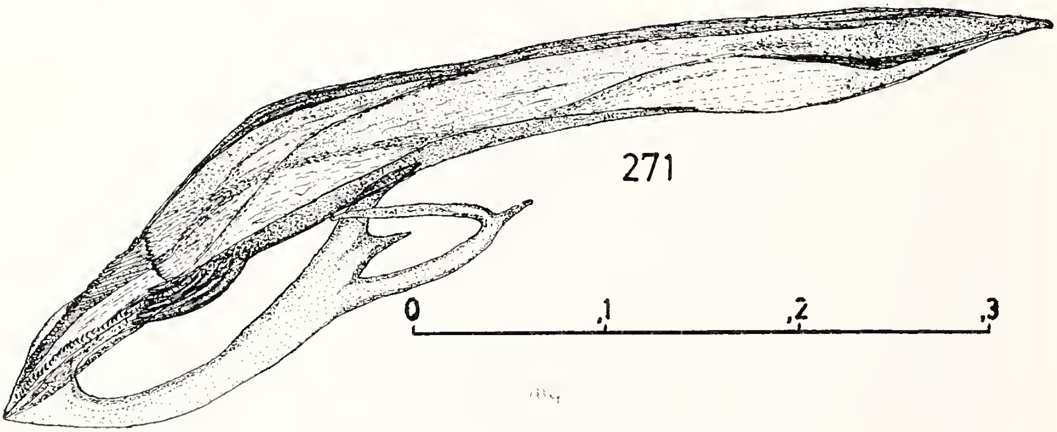


Fig. 271. *A.* (*A.*) *dorsalis* Laf. 271: median lobe of aedeagus.

spaced in median area; sternum consisting of a pair of rather broad plates, well sclerotized along proximal margin. Last exposed sternum with round apex.

MATERIAL EXAMINED. South Africa: Cape of Good Hope, Table Mountain [3318CD], 1906, 1 ♂, Krekich det., (W. Bevins) (NMW); False Bay, 2 miles east of Muizenberg [3418AB], general sweeping, 3.i.1972, 4 ♂♂, 6 ♀♀, (Southern Africa Expedition, British Museum) (BMNH); Kasouga [3326DA], sand dunes, to meloid bait, i.1955, 4 ♂♂, (M. J. A. Cooke) (AMSA); Knysna [3423AA], to meloid bait, 10.ii.1970, 1 ♂, (J. C. van Hille) (AMSA); Swart Vlei [3422BA], to meloid bait, i.1957, 1 ♂, (J. C. van Hille) (AMSA).

*Anthicus (Aulacoderus) perlucidus* van Hille, Figs 272–274
*Anthicus (Aulacoderus) perlucidus* van Hille, 1971: 371–374

Size. Length 1,9 mm (1,70–2,20); width over broadest part of elytra 0,83 mm (0,78–0,91).

*Head.* Glossy, light brown; posterior arch semi-circular to eyes, narrowing to mouthparts; with fine punctures and short hairs pointing forwards and outwards.

*Prothorax.* Glossy, light brown; longer than broad, narrower than head; shoulders angular with two pairs of erect lateral hairs, one pair on shoulder angle, other pair half-way between shoulders and lateral constrictions; punctures more distinct and slightly closer than on head, with fine recumbent hairs; lateral constrictions at $\frac{2}{3}$ of the lengthof prothorax, each with an inwards pointing apophysis with spiral markings.

*Elytra* (Fig. 273). Glossy, transparent, light testaceous with dark transverse band in middle, not reaching lateral margin in most specimens, nor median suture; subapically a second transverse dark band; punctures coarser and less dense and recumbent hairs longer than on prothorax.

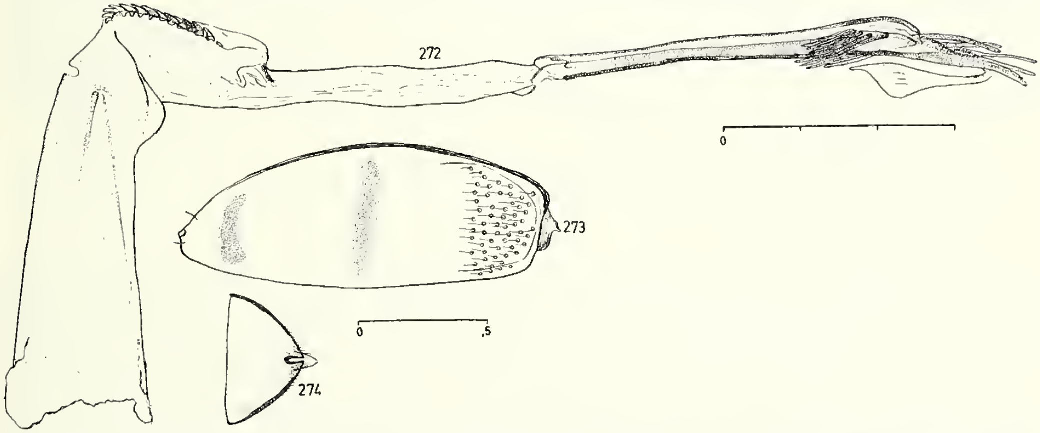
*Wings.* Fully developed.

*Antennae.* Light testaceous and slender, apical three segments broader and black; last segment shorter than two preceding ones together.

*Legs.* Light testaceous.

*Undersurface.* Light testaceous, abdomen darker.

*Male abdomen.* Aedeagus (Fig. 272): median lobe slender and straight, with apical point



Figs 272–274. *A.* (*A.*) *perlucidus* van Hille. 272: aedeagus. 273: elytron of male. 274: last exposed abdominal tergum of female.

and elongate genital opening with beaded margin; a pair of distally pointing spines at distal end of genital opening and a similar pair at proximal end of genital opening; opposite the distal pair of spines is attached the broad ventral spine which points proximally; proximal to genital opening a paired group of ten distally pointing spines; connecting membrane with about 14 single dorsal teeth; tegmen with basal piece 5–6 times as long as apical piece. Retracted segment: tergum rather broad with transverse subapical dark line and parallel row of fenestrae interrupted in the median area. Last exposed sternum slightly flat at apex.

*Female abdomen.* Last exposed tergum (Fig. 274) with short apical slit.

Material examined. South Africa: Sibaya [2732BC], to meloid bait, i.1967, Paratypes 4 ♂♂, (J. C. van Hille) (AMSA); same locality, to meloid bait, vii.1967, Paratypes 287 ♂♂, (M. W. Mansell) (AMSA); Kosi Bay [2632DD], to meloid bait, i.1967, Paratypes 13 ♂♂, (J. C. van Hille) (AMSA); same locality, to meloid bait, vii.1967, Paratypes 221 ♂♂, (M. W. Mansell) (AMSA); same locality, to meloid bait, i.1968, 2 ♂♂, (M. W. Mansell) (AMSA); Boknes [3326DA], to meloid bait, i.1948, 8 ♂♂, (J. C. van Hille) (AMSA); Kleinemonde [3326DB], to meloid bait, 16.iv.1947, 7 ♂♂, (J. C. van Hille) (AMSA); same locality, to meloid bait, i.1954, Paratypes 20 ♂ ♂, (J. C. van Hille) (AMSA); Gualana River Mouth [3327AD], to meloid bait, i.1952, 6 ♂ ♂, (J. C. van Hille) (AMSA). Transkei: Dwega Nature Reserve, [3327AD], to meloid bait, 17.ii.1977, 15 ♂♂, (J. C. van Hille) (AMSA). Mozambique: Delagoa Bay, Inhaca Island 2532DD, xii.1954, 1 ♀, (E. McC. Callan) (AMSA).

### *Anthicus (Aulacoderus) hendeli* Pic, Figs 275–277

*Anthicus (Aulacoderus) hendeli* Pic, 1913a: 379

Size. Length 1,62 mm; width over broadest part of elytra 0,70 mm.

*Head.* Glossy, testaceous; posterior arch very broadly round, diverging to eyes; punctures distinct with long grey procumbent hairs. Eyes rather small, bulging.

*Prothorax.* Glossy, testaceous; broader than long, narrower than head; shoulders sloping and angular, with two pairs of long erect lateral hairs, one pair on shoulder angles, the other pair half-way between shoulder and base; punctures closer than on head with grey recumbent hairs, shorter than on head; lateral constrictions at $\frac{4}{5}$ of the length of prothorax; with long hairs and connected by a transverse hairy groove.

*Elytra.* Glossy, testaceous with incomplete transverse dark band in middle, reaching neither lateral margins nor median suture; a less distinct median dark spot at posterior quarter; punctures more widely spaced than on prothorax with long recumbent hairs and a number of erect hairs, especially along lateral margins.

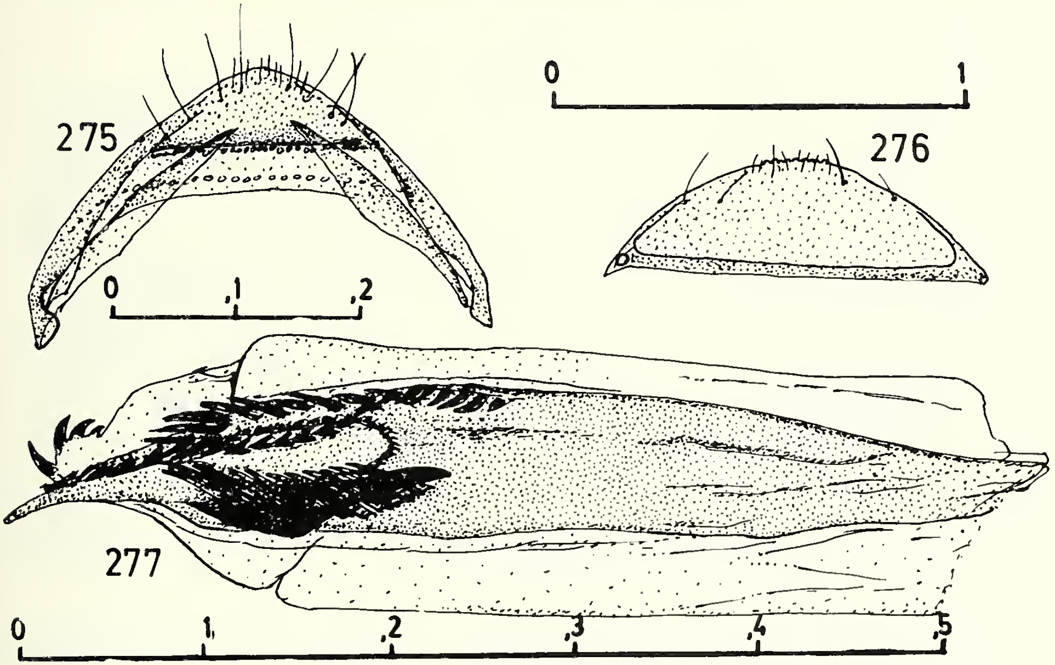
*Wings.* Fully developed.

*Antennae.* Testaceous, last three segments broader and darker, but apical half of last segment lighter; last segment almost as long as two preceding ones together.

*Legs.* Testaceous.

*Undersurface.* Testaceous.

*Male abdomen.* Aedeagus (Fig. 277): median lobe apically pointed, with large subapical oval genital opening with beaded margin; on each side of genital opening a longitudinal row of about 11 apically pointed spines; with subapical broad proximally pointing spine; connecting membrane with row of about 30 single teeth; tegmen lightly sclerotized, basal piece five times as long as apical piece. Retracted segment (Fig. 275): tergum triangular, apex pointed with several long hairs; with dark transverse subapical line and two transverse rows of fenestrae, those of the proximal row larger than those of the distal row; sternum consisting of a pair of narrow pointed plates. Last exposed sternum (Fig. 275) with blunt apex with finely serrated margin.



Figs 275–277. *A.* (*A.*) *hendeli* Pic. 275: retracted abdominal segment of male. 276: last exposed abdominal sternum of male. 277: aedeagus.

Material examined. Kenya: coast Tiwi to Gaza, xi.1911, Type 1 ♂, (Alluaud & Jeannel) (MNHN).

Type locality is Tanzania. Specimens collected in Kenya are mentioned by Pic (1914). This species is figured on his Plate II, no. 9. The illustration is of a ♀ specimen; it differs from ♂, collected on same expedition by shorter prothorax and rounder shorter elytra. The author has not seen specimens from the Type locality.

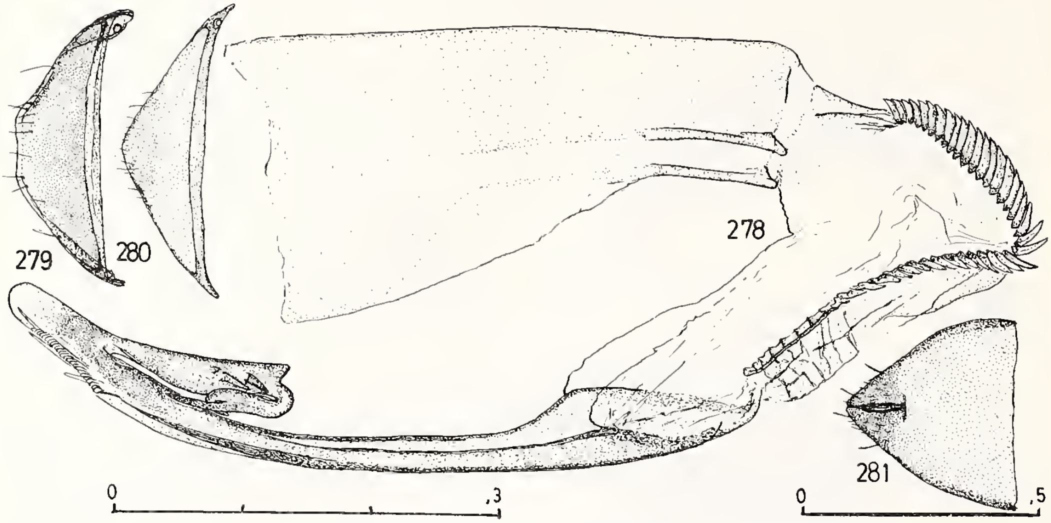
*Anthicus (Aulacoderus) amplus* Pic, Figs 278–281
*Anthicus (Aulacoderus) amplus* Pic, 1895b: 106

Size. Length 2,48 mm (2,25–2,70); width over broadest part of elytra 0,85 mm (0,75–0,93).

*Head.* Little glossy, dark testaceous; posterior arch round or slightly narrower; distinctly punctured, hairs procumbent. Eyes slightly bulging.

*Prothorax.* Little glossy, somewhat lighter than head, basal area light testaceous; longer than broad, narrower than head; shoulders round, each with an erect lateral hair; punctures distinct but very fine on posterior area, with recumbent hairs; lateral constrictions at ⅔ of length of prothorax, with some long lateral hairs, connected by a dorsal transverse depression.

*Elytra.* Somewhat glossy, dark testaceous with three pairs of more or less distinct lighter areas: (1) lateral shoulder areas; (2) pair of maculae just before the middle; (3) apical or subapical area; 1 and 3 may be vague or even not discernable, 2 variable in size and shape; convex with well developed shoulders; punctures with recumbent hairs and a few not very long erect hairs on apical area.



Figs 278–281. *A.* (*A.*) *amplus* Pic. 278: aedeagus. 279: last exposed abdominal sternum of male. 280: last exposed abdominal sternum of female. 281: last exposed abdominal tergum of female.

*Wings*. Fully developed.

*Antennae*. Testaceous, three apical segments little broader and dark testaceous; last segment almost as long as two preceding ones together.

*Legs*. Light testaceous, coxae and femora little darker.

*Undersurface*. Dark testaceous.

*Male abdomen*. Aedeagus (Fig. 278): median lobe dorsally convex; with subapical elongate genital opening with beaded margin and a few spines on each side; with complicated curved ventral spine, forked at apex and with some lateral spines; connecting membrane with about 40 single teeth; tegmen with basal piece six times as long as apical piece. Retracted segment: tergum with dark transverse line formed by short longitudinal dark bars lying closely together; in some specimens this is better visible than in others; another dark line closely parallel to apical margin; transverse row of fenestrae along proximal margin, in median area fenestrae are widely spaced; sternum consisting of pair of triangular plates. Last exposed sternum (Fig. 279) with flat apex.

*Female abdomen*. Last exposed tergum (Fig. 281) triangular with apical narrowly margined groove. Last exposed sternum (Fig. 280) apically pointed.

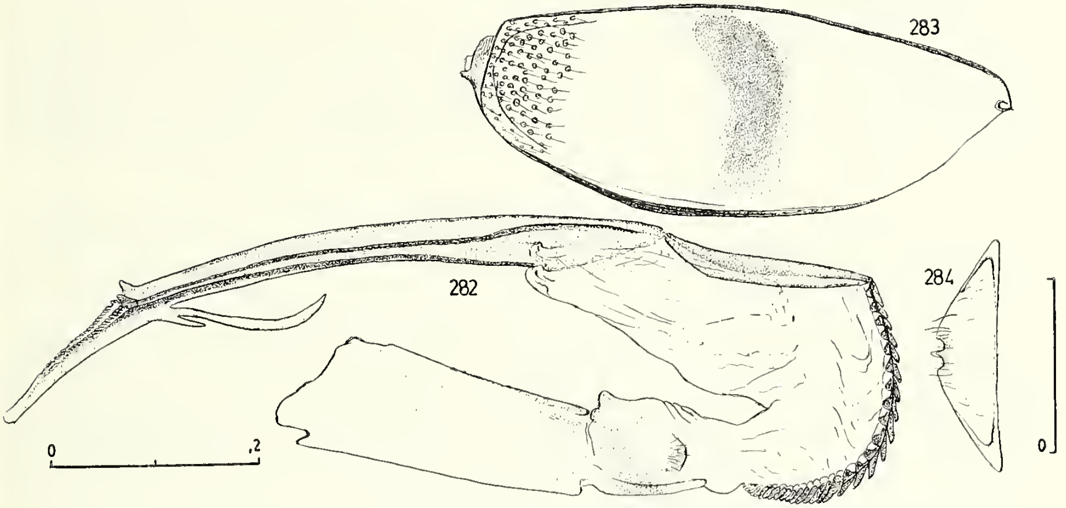
MATERIAL EXAMINED. South Africa: along the coast from Langebaan [3318AA] to East London [3327BB], various dates, many specimens, (J. C. van Hille) (AMSA).

This species resembles *A.* (*A.*) *albitarsis*. Both species have a strictly coastal distribution but their areas overlap over a considerable distance; *A.* (*A.*) *amplus* extends further west, *A.* (*A.*) *albitarsis* further east.

*Anthicus (Aulacoderus) sibayensis* van Hille, Figs 282–284
*Anthicus (Aulacoderus) sibayensis* van Hille, 1971, 374–376

Size. Length 1,83 mm (1,61–2,21); width over broadest part of elytra 0,70 mm (0,61–0,83).

*Head*. Glossy, testaceous; posterior arch longitudinally oval to the eyes, then narrowing to



Figs 282–284. *A.* (*A.*) *sibayensis* van Hille. 282: aedeagus. 283: elytron of male. 284: last exposed abdominal sternum of male.

mouthparts; with fine punctures and short procumbent hairs, laterally pointing somewhat outwards. Eyes slightly bulging.

*Prothorax*. Glossy, lighter than head but in dark specimens same colour as head; longer than broad, narrower than head; shoulders round with lateral pair of erect hairs at greatest width and another pair of erect hairs half-way between shoulders and lateral constrictions; punctures as dense but finer than on head, with recumbent hairs; lateral constrictions at $\frac{3}{4}$ of length of prothorax, each with an inwards pointing apophysis with spiral marking; constrictions connected by transverse dorsal depression.

*Elytra* (Fig. 283). Glossy, testaceous with transverse dark band in middle; punctures coarser but as dense as on prothorax, hairs longer; some longer semi-erect hairs especially along posterior lateral margin.

*Wings*. Fully developed.

*Antennae*. Slender, light testaceous, apical three segments broader and black; last segment as long as two preceding ones together.

*Legs*. Light testaceous.

*Undersurface*. Testaceous, abdomen slightly darker than thorax.

*Male abdomen*. Aedeagus (Fig. 282): median lobe dorsally slightly convex, with elongate subapical genital opening with beaded margin and two short dorsal points at its proximal end; with ventral proximally pointing spine with two unequal arms, proximal one much longer than distal one; connecting membrane with elongate sclerite between base of median lobe and dorsal row of about 30 single teeth; tegmen: basal piece two and a half times as long as apical piece. Retracted segment: tergum with transverse subapical dark line and parallel row of fenestrae, shortly interrupted in middle; sternum consisting of pair of broad plates. Last exposed sternum (Fig. 284) with small apical point in middle of apical indentation.

MATERIAL EXAMINED. South Africa: Ifafa Beach [3030BC], xii.1947, Paratypes 4 ♂♂, 4 ♀♀, (E. T. M. Reid) (AMSA); Sibaya [2732BC], to meloid bait, i.1967, Holotype ♂, Paratypes 15 ♂♂, (J. C. van Hille) (AMSA); same locality, to meloid bait, i.1968, Paratypes 10 ♂♂, (M. W. Mansell) (AMSA).

This species resembles *A.* (*A.*) *perlucidus* in many points but distributions are different although overlapping. Both are strictly coastal. *A.* (*A.*) *sibayensis* is adapted to warmer conditions; in Sibaya it is collected only in summer and it is recorded no further south than Ifafa Beach in Natal. *A.* (*A.*) *perlucidus* has been collected as far south as the Eastern Cape Province and it occurs in Sibaya in much larger numbers in winter than in summer.

*Anthicus (Aulacoderus) bilineatus* **spec. nov.**, Figs 285–288

Size. Length 2,37 mm (2,19–2,51); width over broadest part of elytra 0,80 mm (0,70–0,88).

*Head* (Fig. 287). Glossy, testaceous; posterior arch round; punctures fine with fine white procumbent hairs; a pair of erect lateral hairs behind eyes. Eyes bulging.

*Prothorax* (Fig. 287). Glossy, testaceous; longer than broad, narrower than head; shoulders sloping and round; punctures very fine with white recumbent hairs; shoulders with long erect lateral hair; lateral constrictions at $\frac{4}{5}$ of the length of prothorax.

*Elytra* (Fig. 288). Glossy, lighter testaceous than prothorax, two dark transverse bands: (1) behind middle, (2) subapical; in regressively coloured specimens posterior band may be absent; punctures distinct with fine recumbent white hairs, longer than on prothorax; with some longer erect hairs on shoulders and along lateral margin near apex.

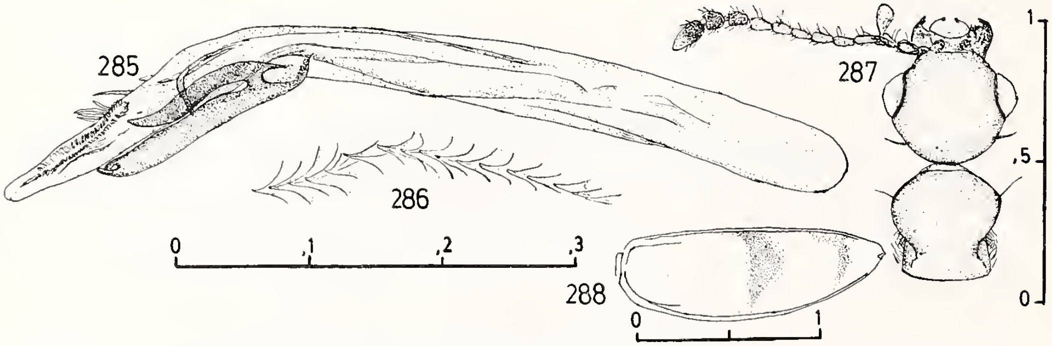
*Wings*. Fully developed.

*Antennae* (Fig. 287). Light testaceous, three apical segments broader and darker; last segment shorter than two preceding ones together.

*Legs*. Light testaceous.

*Undersurface*. Testaceous, abdomen darker than thorax.

*Male abdomen*. Aedeagus: median lobe (Fig. 285) well sclerotized with apical elongate genital opening with beaded margin and some thin spines; ventral spine double pronged, attached to apical third; the dorsal prong of the ventral spine lies to the right of the median lobe, ventral prong ends in two curved hooklets; connecting membrane with dorsal row of about 40 single pointed teeth (Fig. 286) which are little sclerotized; tegmen hardly sclerotized, basal piece 3–4 times as long as apical piece. Retracted segment: tergum with transverse dark line and parallel more proximal row of fenestrae which are widely and irregularly arranged; sternum consisting of a pair of very thin narrow plates. Last exposed sternum apically flat or with very shallow apical indentation.



Figs 285–288. *A.* (*A.*) *bilineatus* spec. nov. 285: median lobe of aedeagus. 286: dorsal row of teeth of connecting membrane of aedeagus. 287: head and prothorax. 288: elytron of male.

MATERIAL EXAMINED. South Africa: Sedgefield [3422BB], bush beating, 14.xii.1970, Holotype ♂, Paratypes 6 ♂♂, 3 ♀♀, (J. C. van Hille) (AMSA); Heidelberg District, Breede Rivier [3420BD], 6.ii.1932, Paratype 1 ♂, (R. E. Turner) (BMNH); Mossel Bay [3422AA], xii.1924, Paratypes 1♂, 1♀, (R. E. Turner) (BMNH); Nature's Valley [3323DC], 9.ii.1970, Paratypes 14 ♂♂, to meloid bait, (J. C. van Hille) (AMSA); Kasouga [3326DA], bush beating, i.1978, 2 ♂♂, 1 ♀, (J. C. van Hille) (AMSA); same locality, west of lagoon, 29.xii.1977, Paratypes 2 ♂♂, 8 ♀♀, (J. C. van Hille) (AMSA).

*Anthicus (Aulacoderus) albitarsis* Laf., Figs 289–298
*Anthicus (Aulacoderus) albitarsis* La Ferté, 1848, 269

Size. Length 2,34 mm (2,14–2,78); width over broadest part of elytra 0,89 mm (0,81–1,00).

*Head* (Fig. 294). Little glossy, dark testaceous; posterior arch longitudinally oval; punctures distinct with procumbent hairs. Eyes somewhat bulging.

*Prothorax* (Fig. 294). Little glossy, dark testaceous with lighter base; longer than broad, narrower than head; shoulders round; punctures distinct with fine recumbent hairs but on basal area punctures are few; lateral constrictions at ⅔ of the length of prothorax, shallow with hairs not specially long; with dorsal transverse basal depression.

*Elytra* (Fig. 295). Somewhat glossy, dark testaceous with two pairs of light maculae, the posterior pair often indistinct or almost absent; not very densely punctured with recumbent hairs and some erect hairs hardly longer than recumbent ones.

*Wings*. Fully developed.

*Antennae* (Fig. 292). Light testaceous, apical three segments black and broader; last segment almost as long as two preceding ones together.

*Legs*. Testaceous to dark testaceous, tarsi lighter.

*Undersurface*. Dark testaceous.

*Male abdomen*. Aedeagus (Figs 289 and 290): median lobe dorsally convex; genital opening subapical with beaded margin; ventral spine attached proximal to genital opening, strongly curved with small transverse pointing spine at point of attachment; connecting membrane with dorsal row of about 28 teeth, the nine teeth nearest the attachment to median lobe single, others in transverse rows of three; tegmen with basal piece four times as long as apical piece; the latter with some lateral apical hairs. Retracted segment (Fig. 293): tergum with slightly pointed apex with some long apical hairs, broad transverse dark line and parallel row of fenestrae; sternum consisting of a pair of squarish plates, connected to tergum by narrow stalk. Last exposed sternum (Fig. 296) apically flat or slightly concave.

*Female abdomen*. Last exposed tergum (Fig. 298) with V-shaped darkly margined apical groove. Last exposed sternum (Fig. 297) apically excavated with point on either side.

MATERIAL EXAMINED. South Africa: coastal area from Mossel Bay [3422AA] to Ifafa Beach [3030BC] various dates, many specimens (AMSA).

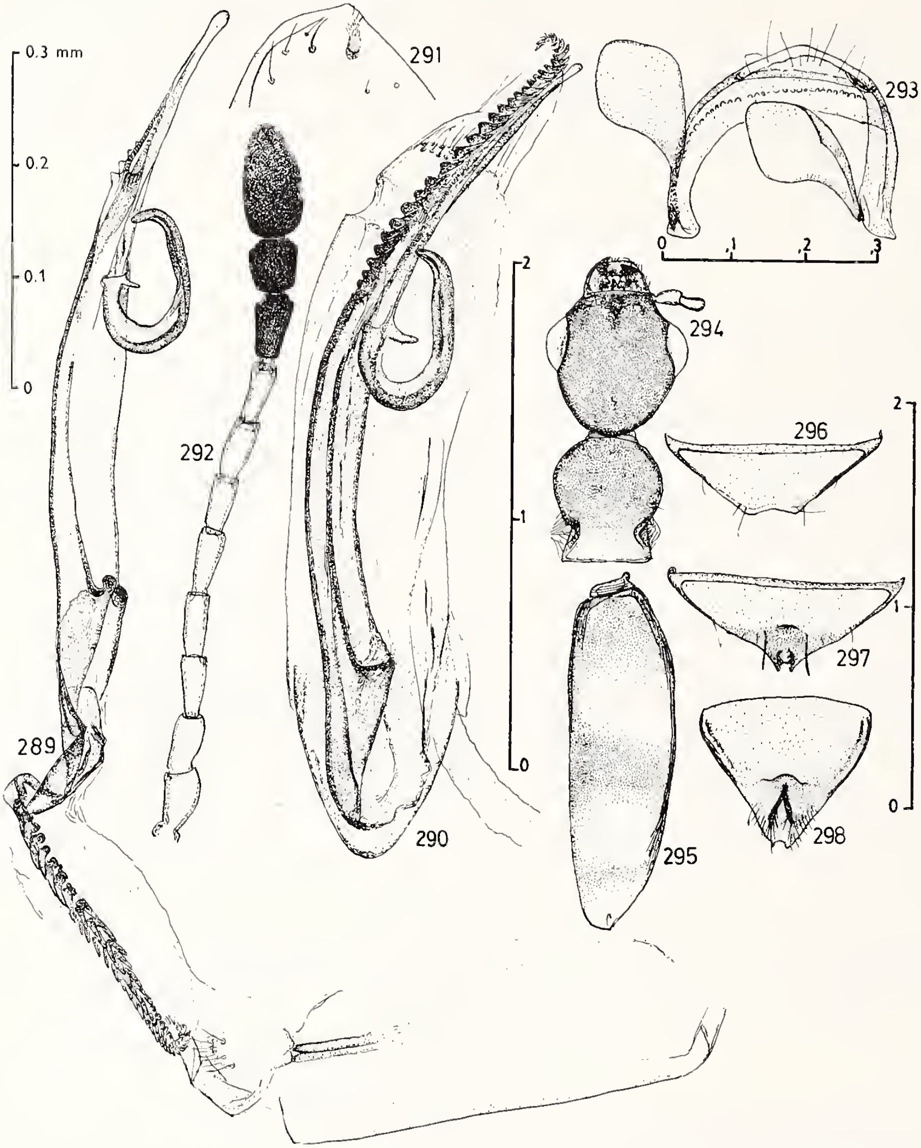
## SECTION 9

The two species of this section are characterized by the small and slender aedeagus with connecting membrane without dorsal teeth; the retracted segment of male has a sternum consisting of a structure with two big hooks on each side.

Both species occur in Zimbabwe.

### Key to the species of Section 9

1 Sternum of retracted abdominal segment of male consists of paired structure with two hooks each, of which the median one is single, the outer one forked (Fig. 301) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . *marshalli*



Figs 289–298. *A.* (*A.*) *albitarsis* Laf. 289: aedeagus. 290: aedeagus inverted. 291: apex of elytron of male. 292: antenna of male. 293: retracted abdominal segment of male. 294: head and prothorax. 295: elytron of male. 296: last exposed abdominal sternum of male. 297: last exposed abdominal sternum of female. 298: last exposed abdominal tergum of female.

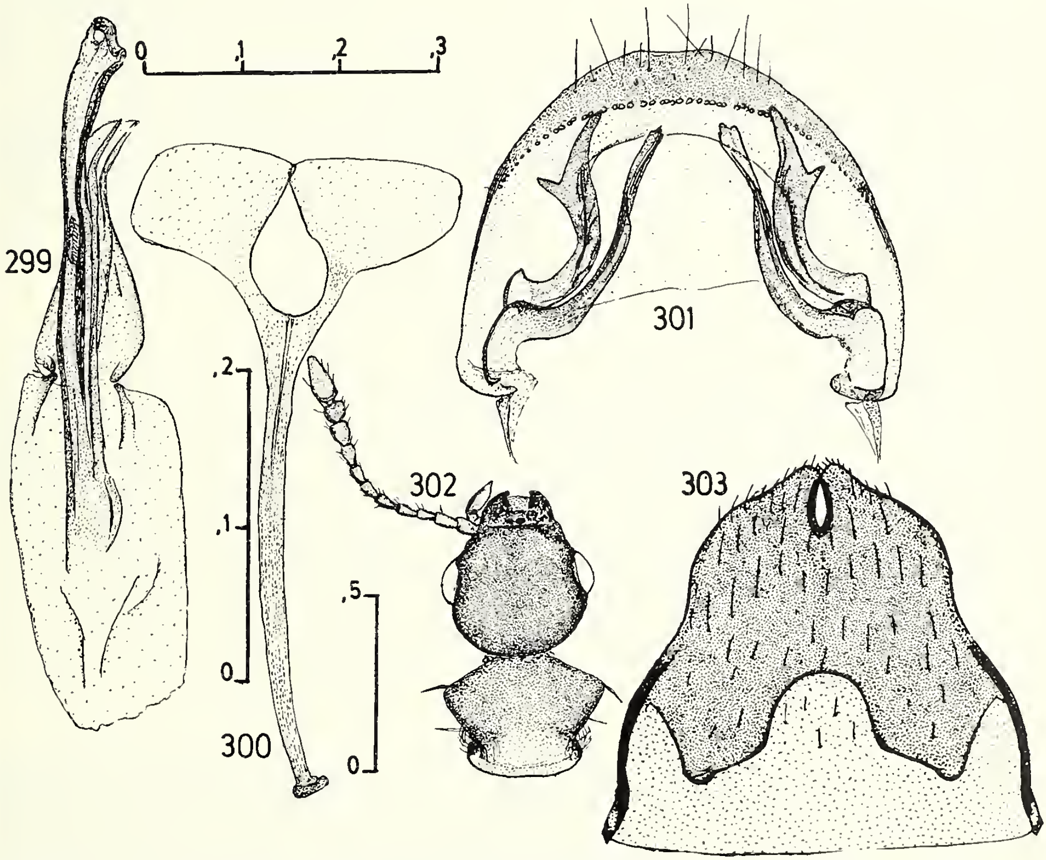
— Sternum of retracted abdominal segment of male consists of a hoop with median blunt distally pointing process and two laterally pointing hooks on each side (Fig. 305) .......................................................... *macchleryi*

*Anthicus (Aulacoderus) marshalli* Pic, Figs 299–303
*Anthicus (Aulacoderus) marshalli* Pic, 1901: 99

Size. Length 1,77 mm (1,72–1,83); width over broadest part of elytra 0,75 mm (0,66–0,81).

*Head* (Fig. 302). Somewhat glossy, dark testaceous; posterior arch broadly round; with fine punctures and fine procumbent hairs. Eyes somewhat bulging.

*Prothorax* (Fig. 302). Slightly glossy, dark testaceous but lighter than head; broader than long, broader than head; with angular shoulders; with two lateral erect hairs on each side; punctures coarser than on head with fine recumbent hairs; lateral constrictions at ¾ of the length of prothorax, with long hairs.



Figs 299–303. *A.* (*A.*) *marshalli* Pic. 299: aedeagus. 300: spiculum gastrale of male. 301: retracted abdominal segment of male. 302: head and prothorax. 303: last exposed abdominal tergum of female.

*Elytra.* Dark testaceous with two pairs of light maculae reaching neither lateral margins nor median suture; with fine punctures which along median suture and lateral margins are accompanied by a dark spot, lying behind the puncture; with fine recumbent hairs and some erect hairs.

*Wings.* Reduced in both sexes.

*Antennae.* Testaceous, apical 3–4 segments gradually broader but not darker; last segment as long as two preceding ones together.

*Legs.* Testaceous, coxae and femora darker.

*Undersurface.* Testaceous.

*Male abdomen.* Aedeagus (Fig. 299) small: median lobe with genital opening situated more than a third of the length of the median lobe from the apex; with a pair of slender parallel sclerites; connecting membrane without row of dorsal teeth; tegmen with basal piece not much longer than apical piece. Retracted segment (Fig. 301): tergum horseshoe-shaped with transverse row of fenestrae; sternum consisting of two hooks on each side of which the outer one has a side hook. Spiculum gastrale (Fig. 300) little sclerotized and pale testaceous with apical arms in the form of thin flat broad plates. Last exposed sternum with small apical indentation.

*Female abdomen.* Last exposed tergum (Fig. 303) with bilobed apex, the lobes surrounding an elongate oval opening; the greater part of apical region with duplicating ventral flap.

MATERIAL EXAMINED. Rhodesia (now Zimbabwe): Salisbury (now Harare), i.1898, Types 2 ♀♀, (no collector) (MNHN); same locality, xi.1900, 1 ♂, (G. A. K. Marshall) (BMNH); same locality, i.1898, 1 ♀, Pic det., (no collector) (BMNH); same locality, 28.xii.1950, 3 ♂♂, (C. N. Smithers) (AMSA); same locality, 19.i.1957, 3 ♂♂, (R. M. Arnold) (AMSA); same locality, 21.i.1957, 3 ♂♂, 1 ♀, (C. N. Smithers) (AMSA).

### *Anthicus (Aulacoderus) macchleryi* **spec. nov.**, Figs 304–307

Size. Length 2,08 mm (1,87–2,47); width over broadest part of elytra 0,80 mm (0,69–0,88).

*Head.* Somewhat glossy, testaceous to dark testaceous; posterior arch broadly round; with distinct punctures and fine procumbent hairs. Eyes bulging.

*Prothorax.* Somewhat glossy, testaceous; broader than long, narrower than head; shoulders sloping and angular; punctures distinct except on posterior area, with fine recumbent hairs and some erect hairs; lateral constrictions at $\frac{4}{5}$ of the length of the prothorax, with long whitish hairs.

*Elytra* (Fig. 307). Light testaceous, but dark at apex and with dark transverse band behind middle, not reaching lateral margins; punctures distinct with fine recumbent hairs; some erect hairs, especially along lateral margins.

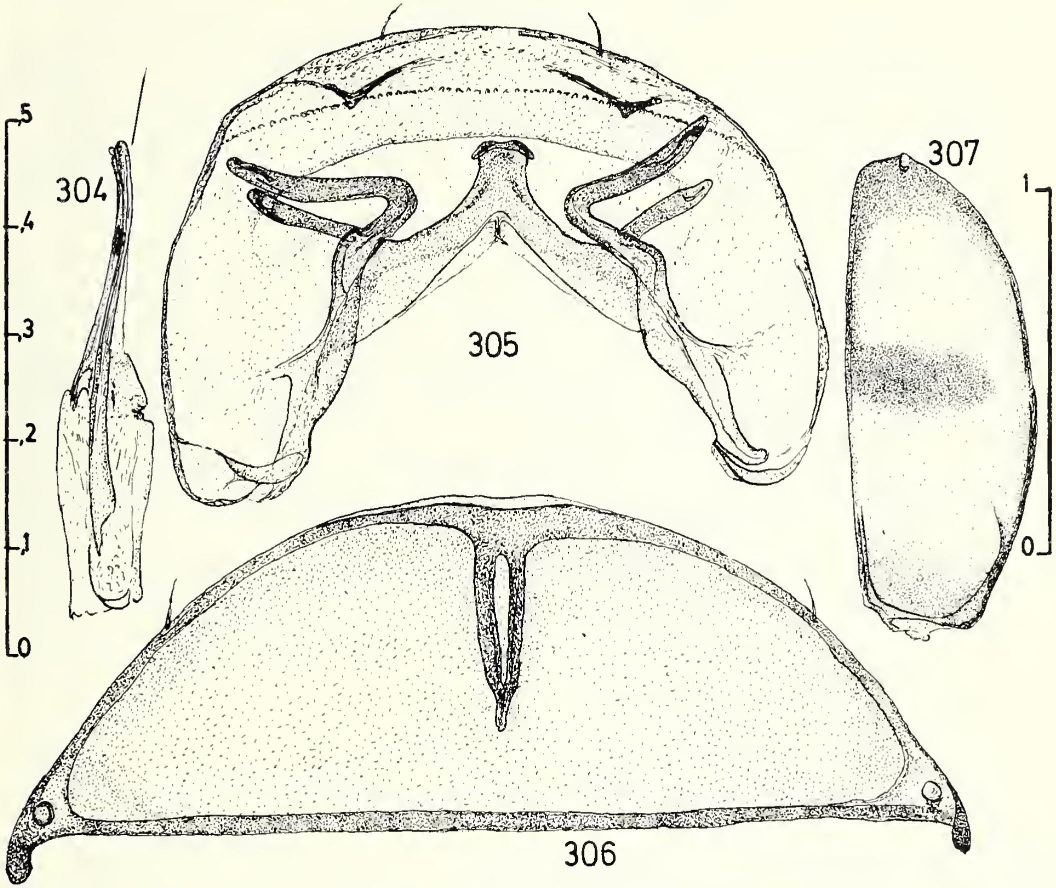
*Wings.* Fully developed.

*Antennae.* Light testaceous, apical 3–4 segments darker and broader, but tip of last segment light; last segment slightly longer than two preceding ones together.

*Legs.* Testaceous.

*Undersurface.* Dark testaceous.

*Male abdomen.* Aedeagus (Fig. 304) small: median lobe slender and simple with small genital opening at apical third; connecting membrane without dorsal teeth; tegmen with basal piece three times as long as apical piece. Retracted segment (Fig. 305): tergum round with transverse row of fenestrae; sternum well sclerotized, consisting of a hoop with median blunt distally pointing projection and two laterally pointing spines on each side. Last exposed sternum (Fig. 306) with dorsal median margined groove.



Figs 304–307. *A.* (*A.*) *macchleryi* spec. nov. 304: aedeagus. 305: retracted abdominal segment of male. 306: last exposed abdominal sternum of male. 307: elytron of male.

MATERIAL EXAMINED. Rhodesia (now Zimbabwe): Salisbury (now Harare), to meloid bait, i.1955, Holotype ♂, Paratypes 9 ♂♂, (A. McChlery) (AMSA); Salisbury (now Harare), 10.xii.1956, Paratypes 2 ♂♂, (C. N. Smithers) (AMSA); to meloid bait, xii.1970, Paratypes 44 ♂♂, (B. W. Blair) (AMSA).

## SECTION 10

The three species in this section are of small size (under two mm), have flat (not convex) elytra and wings are reduced or completely absent. The aedeagus is short and broad with broadly open genital opening; the median lobe is flanked by a pair of strong hooks or several hooks in the case of *A.* (*A.*) *fragilis*. The structure of the aedeagus is very different from that of the species in the Albitarsis Group (Sections 1–8). The mode of operation of the aedeagus is not known.

The three species are found in South Africa, in the Cape Province, Natal and the Transvaal.

### Key to the species of Section 10

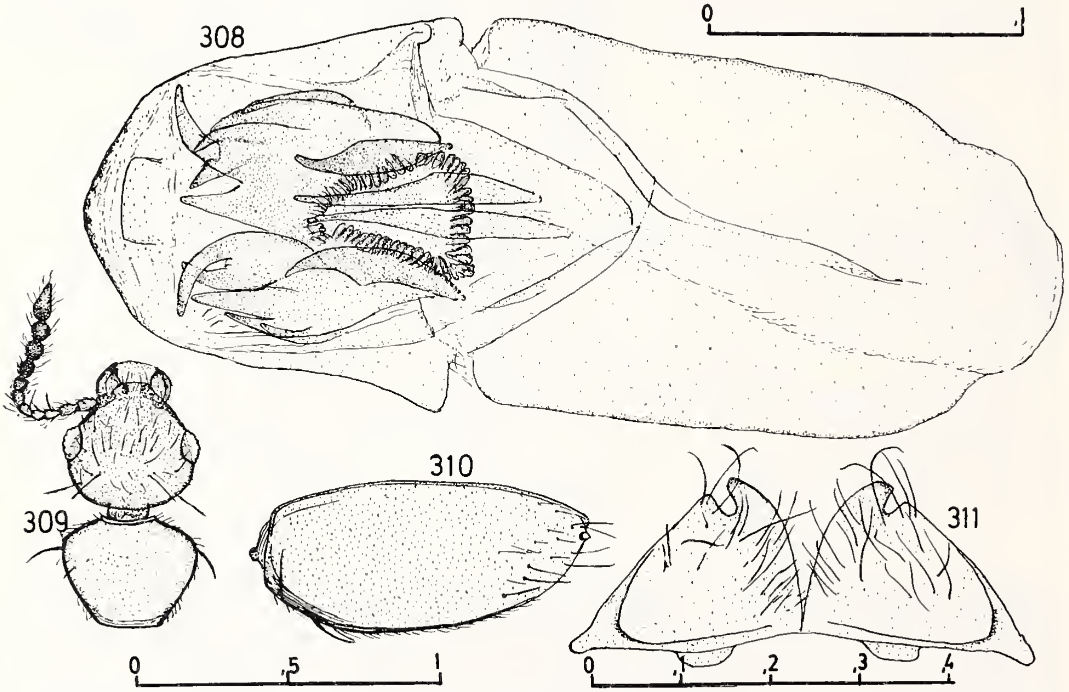
1 Last exposed abdominal sternum of male consists of a pair of sclerites each with subapical indentation (Fig. 311) .............................................. *fragilis*
— Last exposed abdominal sternum of male consists of one sclerite with flat apex ...... 2
2 Median lobe of aedeagus with median structure distal to genital opening, with a pair of two-faced hooks (Fig. 312) .............................................. *pedester*
— Median lobe of aedeagus with a pair of 4–5 pointed sclerites proximal to genital opening (Fig. 313) .............................................. *smithersi*

*Anthicus (Aulacoderus) fragilis* Fåhr., Figs 308–311
*Anthicus (Aulacoderus) fragilis* Fåhraeus, 1870: 335–336

Size. Length 1,62 mm (1,54–1,78); width over broadest part of elytra 0,68 mm (0,55–0,77).

*Head* (Fig. 309). Glossy, dark testaceous in specimens from Natal and Eastern Cape Province, reddish testaceous in Western Cape Province; posterior arch broadly round; with small punctures with fine procumbent hairs and some larger erect hairs on posterior lateral margin between neck and eyes. Eyes small and bulging.

*Prothorax* (Fig. 309). Glossy, somewhat lighter than head; broader than long, as broad as head; shoulders round, each with a long erect hair; lateral constrictions indistinct, but the area is hairy; with small punctures and fine recumbent hairs.



Figs 308–311. *A.* (*A.*) *fragilis* Fåhr. 308: aedeagus. 309: head and prothorax. 310: elytron of male. 311: last exposed abdominal sternum of male

*Elytra* (Fig. 310). Somewhat glossy, light to dark testaceous to black; short and broad; coarsely punctured, with fine recumbent hairs and many erect and semi-erect hairs over whole surface.

*Wings*. Reduced.

*Antennae* (Fig. 309). Short, testaceous; apical 4–6 segments somewhat darker in some specimens but in others the difference is slight; last segment shorter than two preceding ones together.

*Legs*. Testaceous.

*Undersurface*. Testaceous to dark testaceous.

*Male abdomen*. Aedeagus (Fig. 308): median lobe short with triangular genital opening with grooved margin, surrounded by about 15 pointed spines of different size and shape; connecting membrane unarmed; tegmen lightly sclerotized, apical piece with round apex, basal piece less than twice as long as apical piece. Retracted segment: tergum lightly sclerotized with transverse row of fenestrae; sternum consists of a pair of narrow plates and in addition there is a transverse slender bar which connects the basal ends of the tergum. Last exposed sternum (Fig. 311) completely divided in right and left half, each with a subapical lateral indentation and with a number of long hairs.

MATERIAL EXAMINED. South Africa: Natal, Kloof [2830DD], 1500 ft., 1 ♂, (R. E. Turner) (BMNH); Van Reenen [2829AD], xi.1926, 2 ♂♂, 3 ♀♀, (R. E. Turner) (BMNH); Cape Peninsula [3418AD], wet leaf litter in gulley, 2–3.i.1972, 1 ♂, (Southern African Expedition) (BMNH); Kapland, no date, 1 ♂, with label '*capensis* Pic', (this name was never published), (no collector) (NMW); Grahamstown [3326BC], to meloid bait, x.1952 and iii.1967, 8 ♂♂, (J. C. van Hille) (AMSA); Onrus [3419AC], to meloid bait, ii.1970, 10 ♂♂, (J. C. van Hille) (AMSA); Newlands Cape [3318DC], 101 Kildare Road, to meloid bait, 15.ii.1972, 14 ♂♂, (J. C. van Hille) (AMSA).

### *Anthicus (Aulacoderus) pedester* van Hille, Fig. 312

*Anthicus (Aulacoderus) pedester* van Hille, 1971: 377–378

Size. Length 1,15 mm (1,08–1,26); width over broadest part of elytra 0,44 mm (0,39–0,48).

*Head*. Glossy, reddish testaceous; posterior arch broad and straight with rounded angles to eyes; as long as broad; with fine punctures and short procumbent hairs. Eyes small, little bulging.

*Prothorax*. Glossy, light testaceous; broader than long, broader than head; shoulders sloping and round; with fine punctures and short silky recumbent hairs; lateral constrictions inconspicuous, with silky hairs and connected by a dorsal transverse basal groove.

*Elytra*. Glossy, light testaceous, somewhat transparent; short and broad; very finely punctured, with fine recumbent hairs, slightly longer than on prothorax; in male without apical point, but with shallow opening of elytral gland.

*Wings*. Completely absent; metatergum little developed.

*Antennae*. Light testaceous; rather short; distal 4–5 segments moniliform; last segment shorter than two preceding ones together.

*Legs*. Light testaceous.

*Undersurface*. Light testaceous; metasternum short, resembling that of *A*. (*A*.) *rotundipennis* (Fig. 255).

*Male abdomen*. Aedeagus (Fig. 312): median lobe with a pair of lateral hooks and a median piece ending in a pair of two faced spines; genital opening triangular with grooved margin; connecting membrane not visible; tegmen membranous, basal piece longer than apical piece.

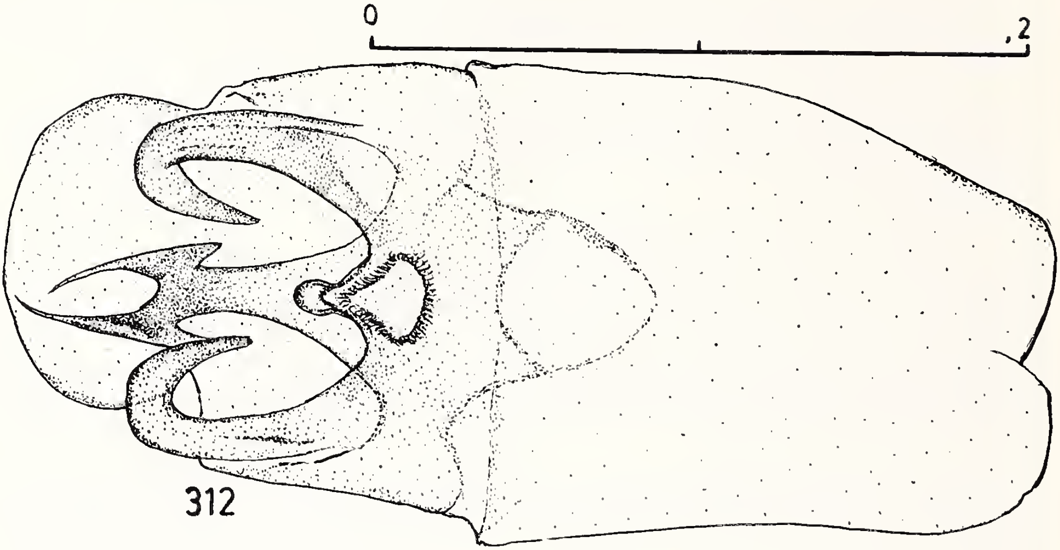


Fig. 312. *A.* (*A.*) *pedester* van Hille. 312: aedeagus.

Retracted segment: tergum rather broad with on each side a transverse row of fenestrae which is absent in the middle; sternum consists of a pair of narrow plates. Last exposed sternum with round distal margin, apex slightly flat.

Material examined. South Africa: Kosi Bay [2632DD], to meloid bait, i.1967, Holotype ♂, Paratypes 42 ♂♂, (J. C. van Hille) (AMSA).

This small species was collected on a light sandy hill slope under a low palm, *Phoenix reclinata*, about 1 km from the north coast of Lake Nhlange. The specimens occurred together with ants, *Pheidole* sp. of approximately the same colour and size.

*Anthicus (Aulacoderus) smithersi* **spec. nov**., Figs 313–316

Size. Length 1,24 mm (1,22–1,25); width over broadest part of elytra 0,42 mm (0,40–0,45).

*Head* (Fig. 315). Glossy, testaceous; posterior arch transversely almost straight, with round angles towards eyes; with minute punctures and short procumbent hairs. Eyes little bulging.

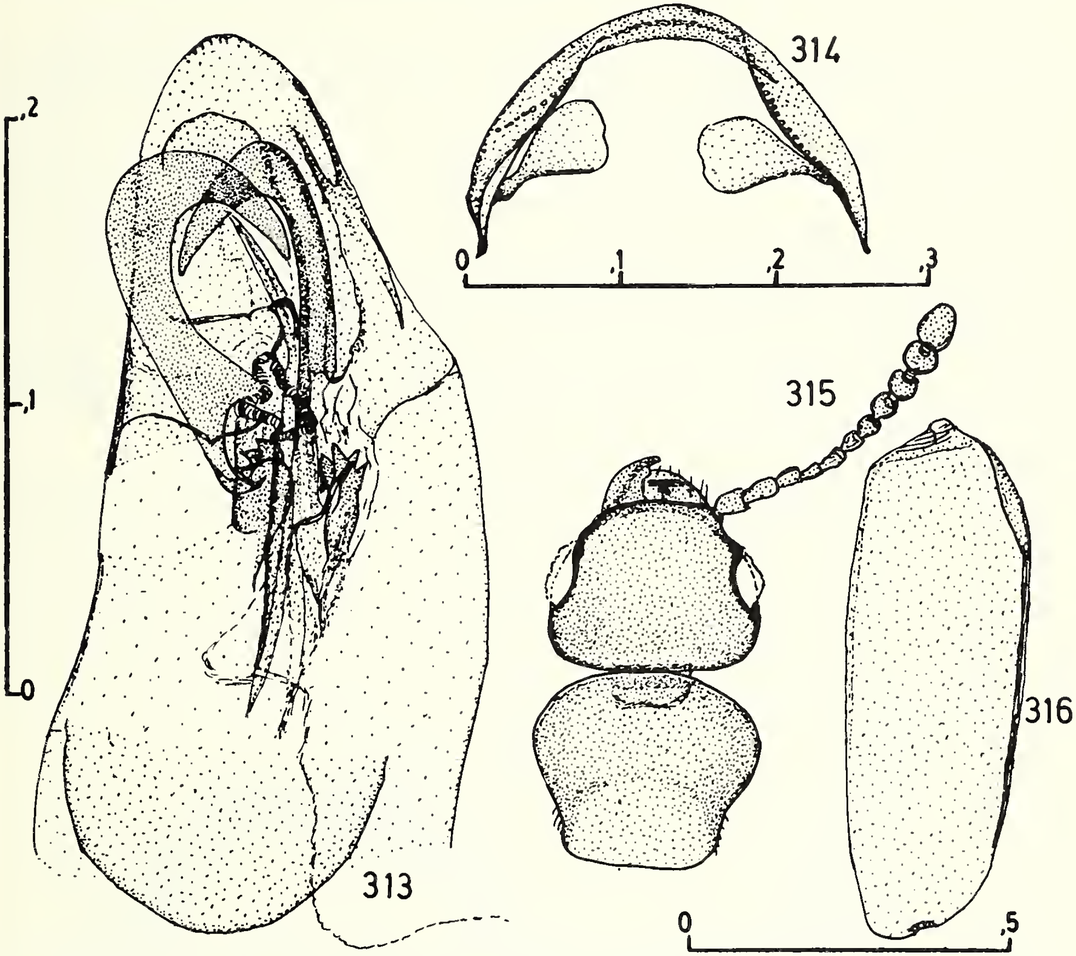
*Prothorax* (Fig. 315). Glossy, testaceous, slightly lighter than head; shoulders round; punctures minute, hairs short and recumbent; lateral constrictions inconspicuous but with some longer hairs.

*Elytra* (Fig. 316). Glossy, testaceous, slightly darker than prothorax, same colour as head; flat, with fine punctures and recumbent hairs, longer than on prothorax. In male without apical point but with shallow apical opening of elytral gland.

*Wings*. Completely absent.

*Antennae* (Fig. 315). Light testaceous; last 4–5 segments moniliform; last segment shorter than two preceding ones together.

*Legs*. Light testaceous.



Figs 313–316. *A.* (*A.*) *smithersi* spec. nov. 313: aedeagus. 314: retracted abdominal segment of male. 315: head and prothorax. 316: elytron of male.

*Undersurface*. Testaceous, abdominal sterna a little darker than thoracic ones; metasternum short.

*Male abdomen*. Aedeagus (Fig. 313): median lobe with a pair of large recurved hooks, broadly open genital opening with grooved margin; proximal to genital opening a pair of sclerites each with 4–5 teeth; connecting membrane not visible; tegmen lightly sclerotized, basal and apical pieces of about equal length. Retracted segment (Fig. 314): tergum with lateral row of fenestrae which are absent in median area; sternum consists of a pair of short broad plates. Last exposed sternum with flat apex.

MATERIAL EXAMINED. South Africa: 16 miles west of Pretoria [2527DB], to meloid bait, 26.xii.1952, Holotype ♂, Paratypes 2 ♂♂, (C. N. Smithers) (AMSA).

## Section 11

The species *Anthicus (Aulacoderus) josensis* **spec. nov**. has no close relations. The aedeagus is short like that of the species of Section 10, but is has none of the typical features of that section. It has been collected in Nigeria and Zaire.

*Anthicus (Aulacoderus) josensis* **spec. nov**., Figs 317–320

Size. Length 2,09 mm (1,85–2,36): width over broadest part of elytra 0,73 mm (0,67–0,89).

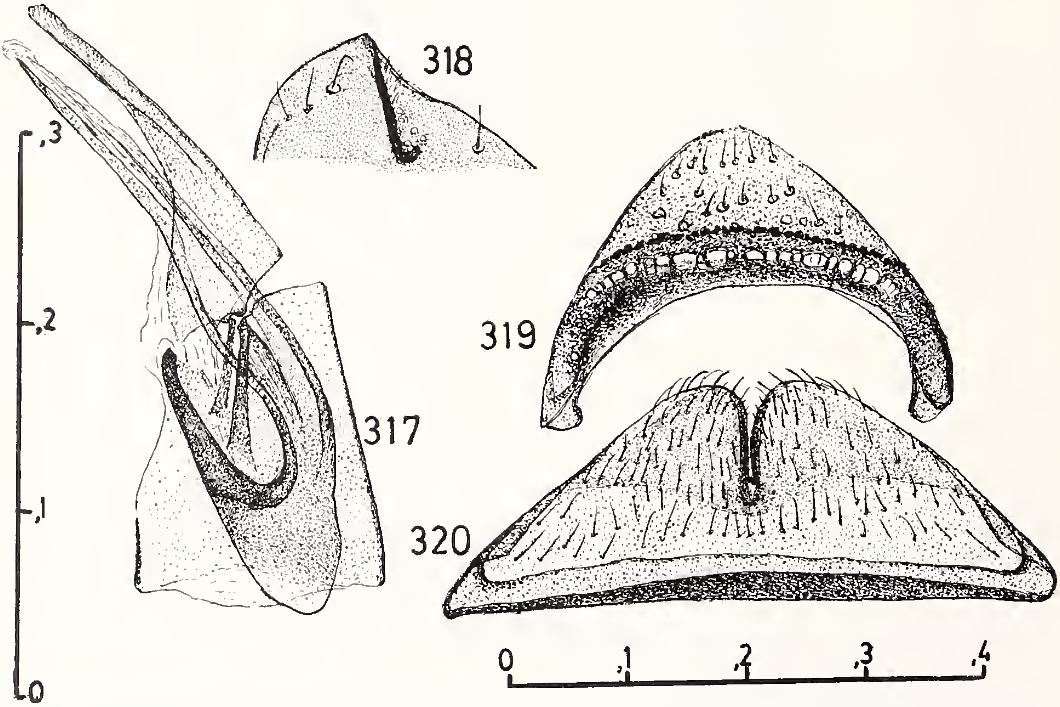
*Head*. Glossy, black; posterior arch oval to round; punctures fine with fine procumbent hairs. Eyes hardly bulging.

*Prothorax*. Glossy, black; as long as broad, narrower than head; shoulders round, each with an erect lateral hair; punctures fine, with fine recumbent hairs and a few erect hairs; lateral constrictions at $\frac{4}{5}$ of the length of the prothorax, with fine long hairs.

*Elytra*. Glossy, black, with well developed shoulders; along the median suture and lateral margins punctures are accompanied by a dark spot behind the puncture; in the middle area this spot is not pigmented and at the apex it is apparently absent; hairs recumbent. In male with elongate apical notch (Fig. 318).

*Wings*. Fully developed.

*Antennae*. Dark testaceous, apical three segments darker and broader; last segment longer than two preceding ones together.



Figs 317–320. *A.* (*A.*) *josensis* spec. nov. 317: aedeagus. 318: apex of elytron of male. 319: tergum of retracted abdominal segment of male. 320: last exposed abdominal sternum of male.

*Legs.* Dark testaceous, tarsi somewhat lighter.

*Undersurface.* Dark testaceous to black.

*Male abdomen.* Aedeagus (Fig. 317): median lobe U-shaped with a long pointed dorsal arm and a short, more sclerotized ventral arm; genital opening not clear, probably at apex of dorsal arm; connecting membrane not visible in preparation; tegmen with apical and basal piece of about equal length. Retracted segment: tergum (Fig. 319) broad with blunt apex; with proximal row of rather large fenestrae; distal to this a row of dark spots; sternum consisting of a pair of short and very narrow sclerites. Last exposed sternum (Fig. 320) for more than half its length divided by apical incision.

*Female abdomen.* Last exposed sternum with small apical point.

MATERIAL EXAMINED. Nigeria: Jos, 20.x.1955, Holotype ♂, Paratypes 1 ♂, 1 ♀, (Expedition Museum Frey, J. Bechyne) (AMSA). Kamerun: Joko, no date, Paratypes 15 specimens, (Heyne) (NMW). Congo (now Zaire): Parc national Garamba II/fd/2, marécage, 28.iii.1951, Paratype 1; II/hd/8, tête de source, 26.ix.1951, Paratype 1, II/fc/4, savane herbeuse, 22.ix.1952, Paratype 1, (Mission H. de Saeger) (MRAC).

## SECTION 12

The four species of this section are characterized by the combination of the following features:

(1) The last abdominal sternum of the male consists of two separate sclerites, attached to each other at the proximal median corner.
(2) The mesepimerite apophyses are short and broad, without spiral markings (Fig. 3).
(3) Dorsal to the median lobe of the aedeagus lies a recurved hook which is attached to the connecting membrane (Fig. 334).

The species of this section have been collected in South West Africa, Zaire and Sudan.

### Key to the species of Section 12

1 Sternum of retracted abdominal segment of male consists of a single sclerite (Fig. 325) .......... *maynei*
— Sternum of retracted abdominal segment of male consists of a pair of separate sclerites .......... 2
2 Median lobe of aedeagus with two short apical spines (Fig. 329) .......... *seydeli*
— Median lobe of aedeagus without apical spines .......... 3
3 Median lobe of aedeagus with apical genital opening (Fig. 330) .......... *linnavuorii*
— Median lobe of aedeagus with subapical genital opening (Fig. 335) .......... *kochi*

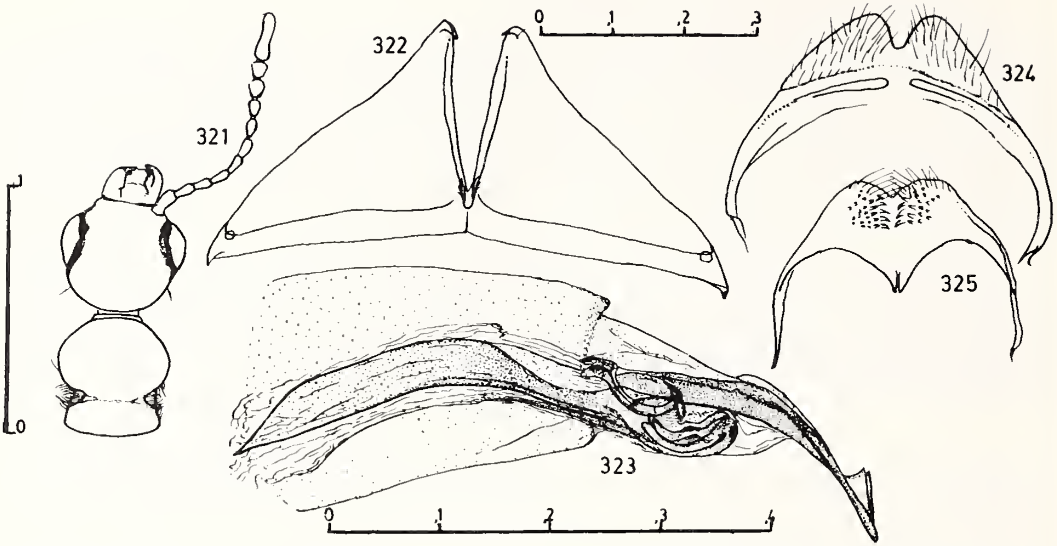
*Anthicus (Aulacoderus) maynei* Pic, Figs 321–325
*Anthicus (Aulacoderus) maynei* Pic, 1913b: 161

Size. Length 2,05 mm (1,80–2,25); width over broadest part of elytra 0,72 mm (0,62–0,80).

*Head* (Fig. 321). Glossy, testaceous to dark testaceous; posterior arch round; with sparse fine punctures and few procumbent hairs. Eyes darkly margined, somewhat bulging.

*Prothorax* (Fig. 321). Glossy, grey testaceous, lighter than head; longer than broad, narrower than head; shoulders sloping and round; with fine sparse punctures and recumbent hairs; with distinct lateral constrictions between posterior third and quarter, connected by dorsal transverse groove.

*Elytra.* Glossy, grey testaceous; somewhat elongate, narrowing to apex; slightly darker



Figs 321–325. *A.* (*A.*) *maynei* Pic. 321: head and prothorax. 322: last exposed abdominal sternum of male. 323: aedeagus. 324: tergum of retracted abdominal segment of male. 325: sternum of retracted abdominal segment of male.

along median suture and with a vague darker median area behind the middle, not reaching lateral margins; with rather sparse fine punctures and recumbent hairs, hardly longer than on prothorax.

*Wings.* Fully developed.

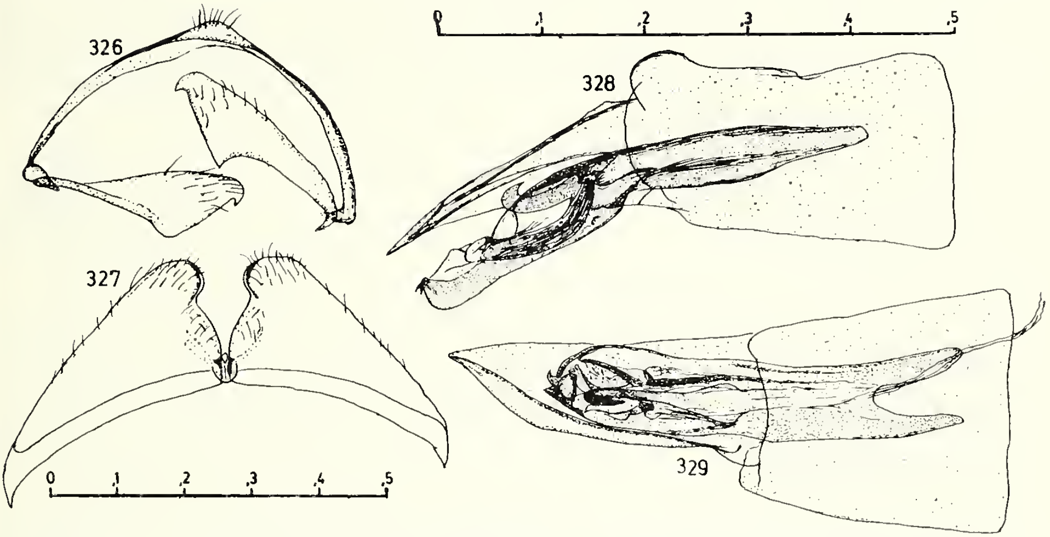
*Antennae* (Fig. 321). Slender, testaceous, apical four segments somewhat broader; last segment slightly constricted in middle and longer than two preceding ones together.

*Legs.* Testaceous.

*Undersurface.* Testaceous, abdomen a little darker than thorax; mesepimerite apophyses with broad triangular base and with blunt apical knob, pointing forwards.

*Male abdomen.* Aedeagus (Fig. 323): median lobe with round genital opening with grooved margin; ventral to the median lobe at the level of the genital opening lie a pair of curved bluntly pointed hooks; dorsal to the median lobe lies a single hook which seems to be homologous with the hook found in *A. (A.) kochi* (Fig. 334) and *A. (A.) seydeli* (Fig. 328) which is attached to the connecting membrane; in the present case the hook is relatively smaller; tegmen with apical piece about as long as basal piece; the latter has a pair of apical triangular hooks, pointing dorsally. Retracted segment: tergum (Fig. 324) apically indented; sternum (Fig. 325) consisting of a single plate, apically less deeply indented than tergum and with a number of small hooks on the apical area, pointing to median line. Last exposed sternum (Fig. 322) consisting of two triangular plates, each with an apical hook pointing inwards; the plates are attached to each other at the base.

MATERIAL EXAMINED. Congo (now Zaire): Mayumbé, Kiniati, 7.vi.1911, 1 ♀, (R. Mayné) (MRAC); Mayumbé, N'Tete, vi–viii.1917, 1 ♂, (R. Mayné) (MRAC); Tshela, xi.1920, 1 ♂, (Dr H. Schouteden) (MRAC); Benza-Masola, 12–15.vi.1911, 1 ♀, (R. Mayné) (NMW).



Figs 326–329. *A.* (*A.*) *seydeli* Pic. 326: retracted abdominal segment of male. 327: last exposed abdominal sternum of male. 328: aedeagus, side view. 329: aedeagus, ventral view.

*Anthicus (Aulacoderus) seydeli* Pic, Figs 326–329
*Anthicus (Aulacoderus) seydeli* Pic, 1952a: 78

Size. Length 2,55 mm (2,13–2,93); width over broadest part of elytra 0,84 mm (0,75–0,95).

*Head.* Mat, very dark testaceous; posterior arch broadly round; punctures very fine with fine short procumbent hairs. Eyes large and bulging.

*Prothorax.* Somewhat glossy, testaceous; longer than broad, narrower than head; shoulders sloping and round; with fine punctures and short recumbent hairs; lateral constrictions at $\frac{3}{5}$ of the length of the prothorax, connected by a dorsal transverse groove.

*Elytra.* Pale testaceous, elongate with well marked shoulders; with anterior narrow dark band covering shoulder region and a triangular dark macula behind the middle, broad at median suture, narrowing towards, but not reaching, lateral margins; the dark markings may be reduced or even be completely absent; punctures fine, recumbent hairs longer than on prothorax.

*Wings.* Fully developed.

*Antennae.* Testaceous, last segment sometimes a little darker and longer than the two preceding ones together.

*Legs.* Pale testaceous.

*Undersurface.* Testaceous; mesepimerite apophyses broadly triangular with small apical pimple (Fig. 3).

*Male abdomen.* Aedeagus (Figs 328 and 329): median lobe with short genital opening with grooved margin and with a pair of short apical spines, some grooves, ridges and unclear spines; connecting membrane not showing up in preparation but has a roundly curved bar with pointed apex; a similar structure occurs in *A.* (*A.*) *kochi* (Figs 334 and 335). In Fig. 328 the median lobe is everted more in relation to tegmen than in Fig. 329 and the curved bar lags behind in the eversion more than the median lobe as is also seen in the figs of *A.* (*A.*) *kochi;* tegmen with pointed apical piece about as long as basal piece. Retracted segment (Fig. 326): tergum with bluntly pointed apex, narrow; sternum consists of a pair of triangular plates, each with an apical curved hook. Last exposed sternum (Fig. 327) consisting of two separate plates, attached at base.

MATERIAL EXAMINED. Congo (now Zaire): Elizabethvile (now Lubumbashi), x-xii.1949, 16 ♂♂, 26 ♀♀, (Ch. Seydel) (AMSA).

Pic (1955) has described *A.* (*A.*) *seydeli* var. *semiobliteratus* Pic on specimens collected in x-xi.1950, Elisabethville in which the dark markings are reduced. In the specimens the author has seen, the colour is variable but he cannot divide the specimens into two groups.

*Anthicus (Aulacoderus) linnavuorii* **spec. nov.,** Figs 330–335

Size. Length 2,19 mm (2,10–2,28); width over broadest part of elytra 0,80 mm (0,75–0,85).

*Head* (Fig. 333). Glossy, testaceous to dark testaceous; posterior arch broadly round; punctures fine with fine procumbent hairs. Eyes large and somewhat bulging.

*Prothorax* (Fig. 333). Glossy, testaceous; longer than broad, narrower than head; shoulders round; punctures more distinct than on head with fine recumbent hairs; lateral constrictions at $\frac{3}{4}$ of the length of the prothorax, well developed with sparse and shortish hairs, not connected by a dorsal transverse groove or depression.

*Elytra* (Fig. 332). Glossy, light testaceous, somewhat darker over shoulders and with dark transverse band behind the middle, extending backwards along median suture; this band is broader in male than in female in the two specimens examined; elongate, with fine punctures and short fine recumbent hairs.

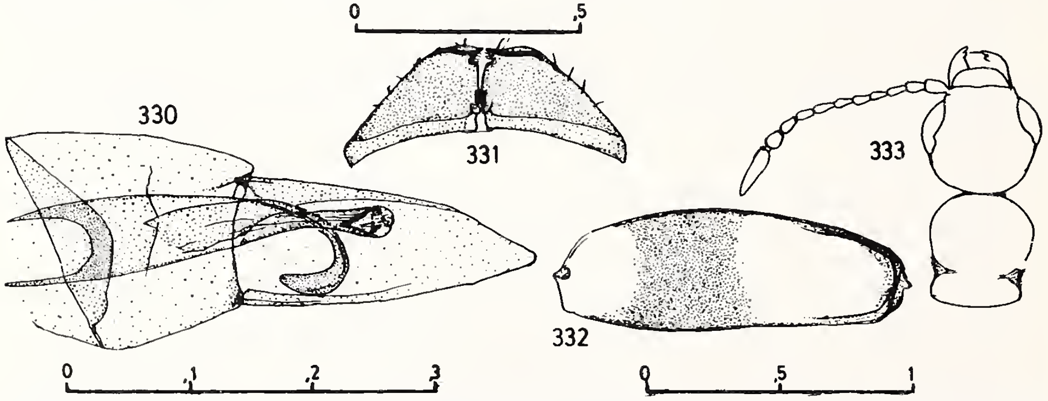
*Wings.* Fully developed.

*Antennae* (Fig. 333). Light testaceous; not darker and hardly broader to apex; last segment as long as three preceding ones together.

*Legs.* Light testaceous.

*Undersurface.* Testaceous, abdomen darker than thorax; mesepimerite apophyses in the form of a broadly based triangle.

*Male abdomen.* Aedeagus (Fig. 330): median lobe simple in shape, narrowing to short apical genital opening with beaded margin; connecting membrane not visible in preparation but



Figs 330–333: *A.* (*A.*) *linnavuorii* spec. nov. 330: aedeagus. 331: last exposed abdominal sternum of male. 332: elytron of male. 333: head and prothorax.

there is a dorsal curved bar with blunt apex which is probably attached to connecting membrane as in *A.* (*A.*) *kochi* (Figs 334 and 335); tegmen: apical piece bluntly pointed, somewhat longer than basal piece. Last exposed sternum (Fig. 331) consisting of two sclerites, connected by a membrane only, each with an apical point pointing inwards.

Material examined. Sudan: Equatoria, Mwolo-Mundri, 24.ii.1963, Holotype ♂, Paratype ♀ (R. Linnavuori) (ZEUH).

*Anthicus (Aulacoderus) kochi* **spec. nov.,** Figs 336–340

Size. Length 3,25 mm (2,74–3,70); width over broadest part of elytra 1,05 mm (1,00–1,22).

*Head* (Fig. 336). Slightly glossy, testaceous; elongate and narrow; posterior arch round; punctures fine with short procumbent hairs. Eyes large and bulging.

*Prothorax* (Fig. 336). Slightly glossy, testaceous; longer than broad, narrower than head; shoulders sloping and round; punctures fine with short recumbent hairs; lateral constrictions at $\frac{3}{4}$ of the length of the prothorax, with rather short hairs.

*Elytra* (Fig. 339). Somewhat glossy, light testaceous with two transverse black bands, the anterior at shoulder area, the posterior behind the middle; punctures bigger than on prothorax and accompanied by a posterior dark spot; recumbent hairs longer than on prothorax.

Wings. Fully developed.

*Antennae* (Figs 336 and 337). Light testaceous, slender and elongate, not darker nor broader at apex; last segment in male longer than two preceding ones together; in female shorter than two preceding ones together.

*Legs.* Light testaceous and slender.

*Undersurface.* Light testaceous; with short and broad mesepimerite apophyses.

*Male abdomen.* Aedeagus (Figs 334 and 335): median lobe broad with blunt apex, in some specimens with a small pair of lateral 'ears'; genital opening short and broad with grooved margin; distal to genital opening on each side a row of inwards and proximally pointing spines; connecting membrane with dorsal longitudinal bar with recurved apical pointed hook; the base of this bar is attached to distal third of connecting membrane and is about half the length of the median lobe; when eversion takes place the median lobe can move outwards over a distance of twice the length of the connecting membrane but the hooked bar over a distance of twice one third of the length of the connecting membrane (Fig. 334). Tegmen with arrow-shaped apex; apical piece is about equal in length to basal piece. Retracted segment (Fig. 340): tergum narrow with bluntly pointed apex; sternum consists of a pair of narrow plates. Last exposed sternum (Fig. 338) consists of two separate plates each with ornamented apex. The last exposed sternum of the female is one sclerite.

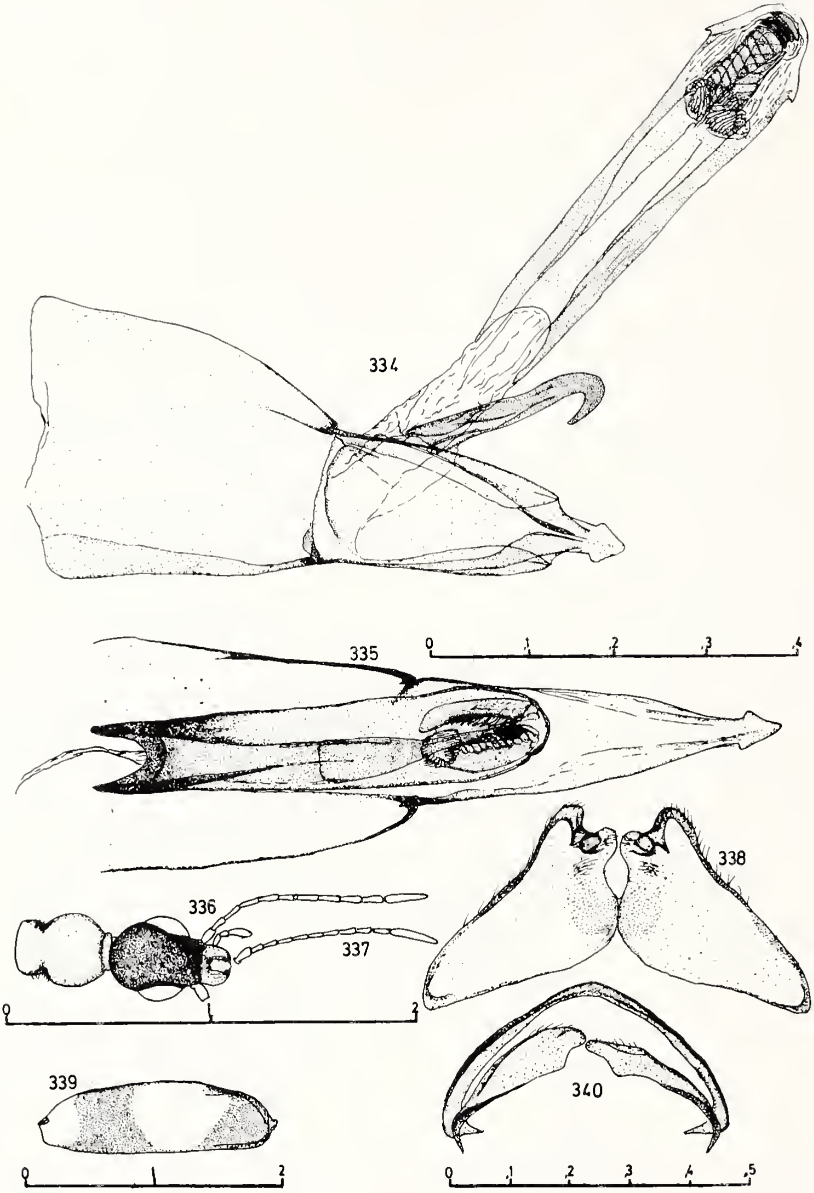
In several specimens the gut is full of pollen.

Material examined. South West Africa: Luderitzbucht [2615CA], xi-xii.1949, Holotype ♂, Paratypes 4 ♂♂, 12 ♀♀, (C. Koch) (AMSA); Abachaus, xii.1946, Paratypes 2 ♂♂, 1 ♀, (G. Hobohm) (BMNH). Botswana: Serowe, viii.1982, Paratype ♂, (P. Forchhammer) (AMSA).

### Section 13

The aedeagus of the species in this section has a short and little sclerotized median lobe, similar to the median lobe of the species of Section 16. However, only in one of the species is there an indication of a sclerotized longitudinal bar in the median lobe, as is found in the species of Section 16. In the present section the tegmen is complicated and mesepimerite apophyses are present in contrast to conditions in the species of Section 16.

The species of this section are from South West Africa, Angola and Zaire.



Figs 334–340. *A.* (*A.*) *kochi* spec. nov. 334: aedeagus, everted. 335: aedeagus, inverted. 336: head and prothorax of female. 337: antenna of male. 338: last exposed abdominal sternum of male. 339: elytron of male. 340: retracted abdominal segment of male.

### Key to the species of Section 13

1 Last exposed abdominal sternum of male with apical indentation (Fig. 342) . . *brucoensis*
— Last exposed abdominal sternum of male apically flat, slightly bulging in middle (Figs 347 and 350) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 2
2 Parameres of tegmen of aedeagus symmetrical (Fig. 345) . . . . . . . . . . . . . . . . . . . *nigricolor*
— Parameres of tegmen of aedeagus asymmetrical (Fig. 349) . . . . . . . . . . . . . . . . . . . *chaboti*

*Anthicus (Aulacoderus) brucoensis* **spec. nov.**, Figs 341–344

Size. Length 2,45 mm (2,17–2,56); width over broadest part of elytra 0,85 mm (0,74–0,91).

*Head* (Fig. 343). Glossy, dark testaceous to black; posterior arch broad; punctures very fine with short fine procumbent hairs. Eyes not much bulging.

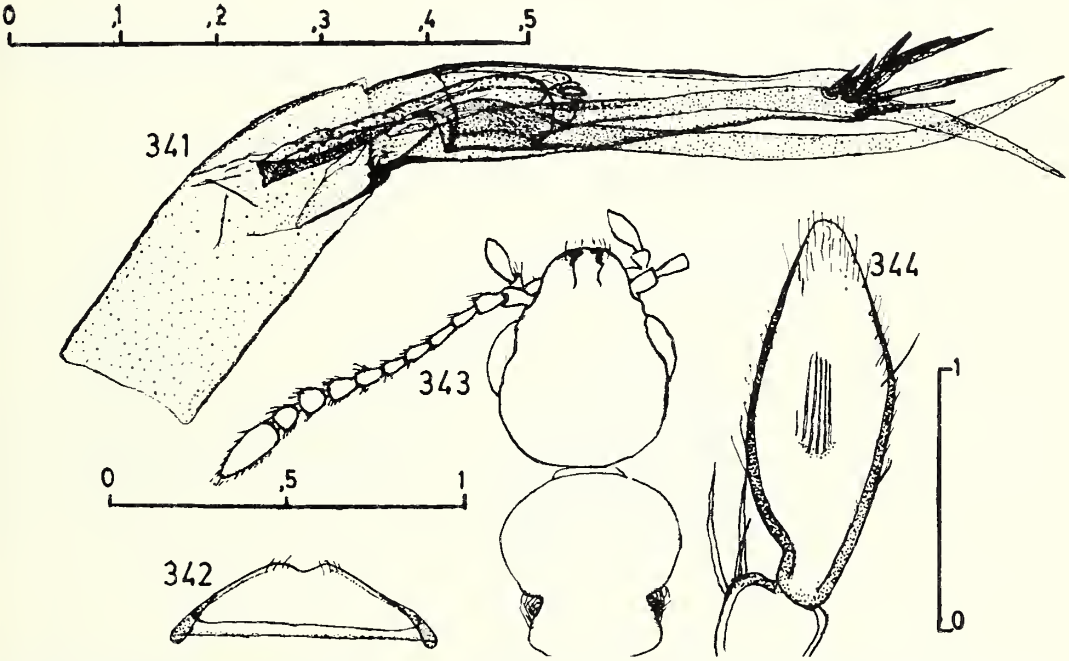
*Prothorax* (Fig. 343). Glossy, dark testaceous; as long as broad, as broad as head; shoulders sloping and round; lateral constrictions at ⅔ of the length of the prothorax, with long hairs; punctures fine with short recumbent hairs.

*Elytra*. Glossy, testaceous with two pairs of vague slightly lighter maculae; elongate with round shoulders; punctures larger than on prothorax; no erect or semi-erect hairs were seen.

*Wings*. Fully developed.

*Antennae* (Fig. 343). Testaceous, slightly broader at apex but not darker; last segment longer than two preceding ones together.

*Legs*. Testaceous.



Figs 341–344. *A.* (*A.*) *brucoensis* spec. nov. 341: aedeagus. 342: last exposed abdominal sternum of male. 343: head and prothorax. 344: last segment of maxillary palp.

*Undersurface*. Dark testaceous.

*Male abdomen*. Aedeagus (Fig. 341): median lobe short and membranous with small narrowly oval genital opening with finely beaded margin; with a lightly sclerotized longitudinal bar, its apex is not clear in the preparation; connecting membrane surrounding base of median lobe with small triangular folds and small pustules; tegmen: apical piece with pair of long slightly curved pointed parameres and a slightly shorter lobe with about eight apical spines; basal piece shorter than apical piece. Last exposed sternum with shallow apical indentation (Fig. 342).

MATERIAL EXAMINED. Angola: Bruco, 26.ii–2.iii.1972, Holotype ♂, Paratypes 4 ♂♂, (Southern African Expedition, British Museum) (BMNH). South West Africa (W 37): Otjitambi Farm 27 miles ESE Kamanjab, 13–15.ii.1972, Paratype ♂, (Southern African Expedition, British Museum) (BMNH).

The Anthicidae have a sense organ on the apical segment of the maxillary palp consisting of a number of parallel grooves. In this species it is well visible (Fig. 344) and consists of 5–6 grooves; its function is not known.

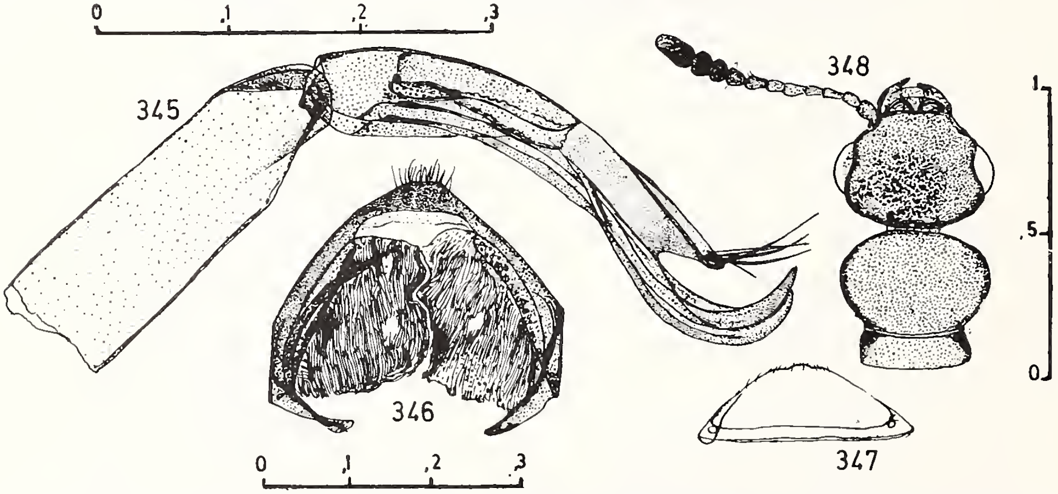
*Anthicus (Aulacoderus) nigricolor* Pic, Figs 345–348

*Anthicus (Aulacoderus) nigricolor* Pic, 1952b: 22

Size. Length 2,15 mm; width over broadest part of elytra 0,75 mm.

*Head* (Fig. 348). Glossy, black; posterior arch broadly round; punctures distinct with fine short hairs, transversely pointing to median line but procumbent on clypeus and labrum. Eyes somewhat bulging.

*Prothorax* (Fig. 348). Somewhat glossy, black; broader than long, narrower than head; shoulders round; punctures dense with recumbent hairs, longer than on head; lateral constrictions at $\frac{3}{4}$ of the length of the prothorax, without long hairs and connected by a dorsal transverse groove.



Figs 345–348. *A.* (*A.*) *nigricolor* Pic. 345: aedeagus. 346: retracted abdominal segment of male. 347: last exposed abdominal sternum of male. 348: head and prothorax.

*Elytra*. Mat, black; punctures fine and dense with recumbent hairs, longer than on prothorax and with some semi-erect hairs; shoulders round.

*Wings*. Fully developed.

*Antennae* (Fig. 348). Dark testaceous, apical 4–5 segments darker and broader; last segment as long as two preceding ones together, slightly lighter at apex.

*Legs*. Dark testaceous to black.

*Undersurface*. Dark testaceous.

*Male abdomen*. Aedeagus (Fig. 345): median lobe membranous, genital opening not clear in preparation; connecting membrane with some small pustules round base of median lobe; tegmen: apical piece with a pair of curved parameres and a shorter lobe with some apical hairs; basal piece shorter than apical piece. Retracted segment (Fig. 346): tergum with flat hairy apex; sternum consists of a fibrous plate with a non-fibrous sinuous median line; this plate fills up practically the whole space between the arms of tergum. Last exposed sternum (Fig. 347) apically flat, but slightly bulging in middle.

MATERIAL EXAMINED. Congo (now Zaire): Katanga, Kundelungu, 1 680 m, Bas L. Moëro, A. Luelaba, 1 ♂, Pic det., (no collector) (MRAC). This is the type locality.

*Anthicus (Aulacoderus) chaboti* Pic, Figs 349–350
*Anthicus (Aulacoderus) chaboti* Pic, 1921: 343

Size. Length 2,13 mm (2,07–2,20); width over broadest part of elytra 0,86 mm (0,82–0,90).

*Head*. Glossy, black; posterior arch broadly round; punctures rather coarse with fine short procumbent hairs. Eyes not much bulging.

*Prothorax*. Hardly glossy, black; slightly broader than long, narrower than head; shoulders round; with close punctures and short recumbent hairs; lateral constrictions at $\frac{3}{4}$ of length of the prothorax, without long hairs, connected by a dorsal transverse groove.

*Elytra*. Somewhat glossy, black; shoulders round; punctures fine with close recumbent hairs, longer than on prothorax; with a few semi-erect hairs, not much longer than recumbent ones.

*Wings*. Fully developed.

*Antennae*. Black, rather short; last four segments broader; last segment longer than two preceding ones together.

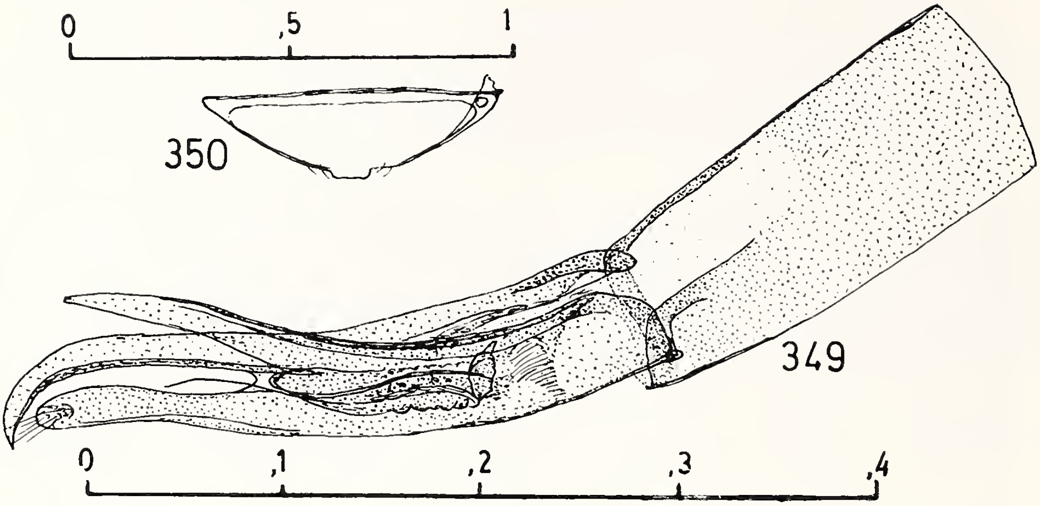
*Legs*. Black, with tarsi dark testaceous.

*Undersurface*. Black.

*Male abdomen*. Aedeagus (Fig. 349): median lobe short and membranous; genital opening not visible in preparation; connecting membrane with fine pustules round base of median lobe; tegmen with apical piece ending in a pair of unequal curved parameres and a median process almost as long as longer paramere, with some apical hairs; basal piece shorter than apical piece. Retracted segment: tergum narrow; sternum consists of a pair of narrow short sclerites. Last exposed sternum (Fig. 350) apically flat but slightly bulging in middle.

MATERIAL EXAMINED. Angola: Benguela, Capelongo-Dongo, xii.1914, 1 ♂, (Mission Rohan Chabot) (MNHN); Angola (A 18), Tundavale, 9 miles NW Sa da Bandeira, general sweeping, 5.iii.1972, 1 ♂, 1 ♀, (Southern African Expedition, British Museum) (BMNH).

The last two species are very similar. The asymmetrical parameres of *A. (A.) chaboti* are not an aberration for both male specimens available show this feature. They also have remarkably different sterna of the retracted abdominal segment of the male.



Figs 349–350. *A.* (*A.*) *chaboti* Pic. 349: aedeagus. 350: last exposed abdominal sternum of male.

## SECTION 14

The most characteristic feature of the two species in this section is the last exposed abdominal sternum of the male, which has a median distally pointing grooved process (Figs 355 and 358); the ventral hook of the median lobe of the aedeagus is also characteristic.

The two species are from the Transvaal, South Africa and Zaire respectively.

### Key to the species of Section 14

1 Last exposed abdominal sternum of male with median grooved process in semi-circular indentation (Fig. 355) .................................... *formicomisternus*

— Last exposed abdominal sternum of male with a pointed process on each side of the median grooved process (Fig. 358) ........................................ *boviei*

*Anthicus (Aulacoderus) formicomisternus* **spec. nov.,** Figs 351–354

Size. Length 1,90 mm (1,79–2,13); width over broadest part of elytra 0,79 mm (0,77–0,84).

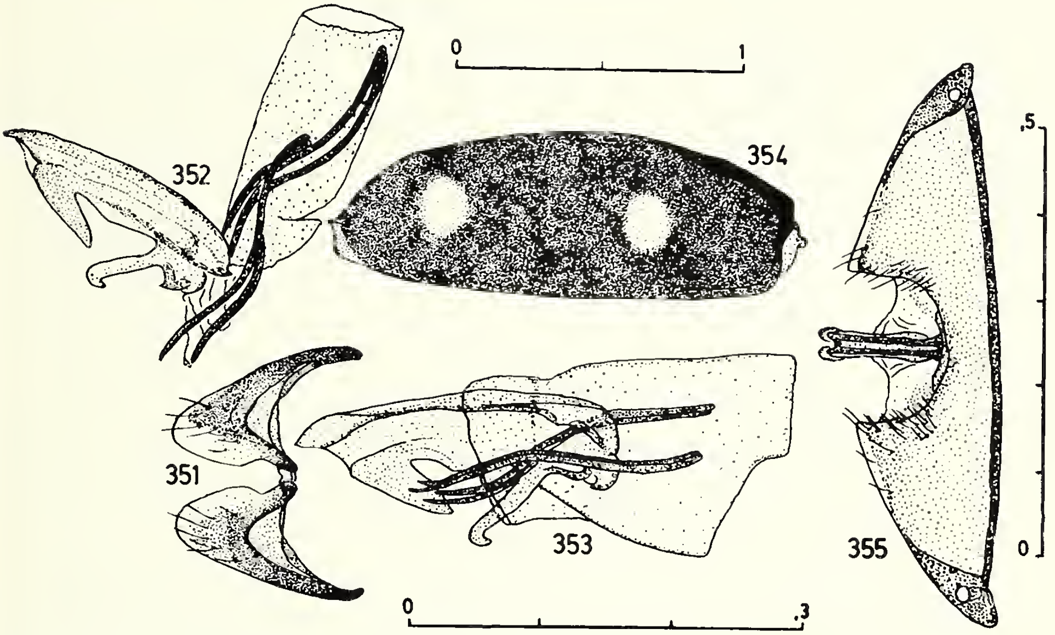
*Head.* Glossy, black; posterior arch broadly round; with sparse punctures with procumbent hairs. Eyes little bulging.

*Prothorax.* Glossy, black; broader than long, broader than head; shoulders slightly sloping with somewhat pointed lateral angles; punctures closer than on head, much reduced in posterior region; lateral constrictions at $\frac{4}{5}$ of the length of the prothorax, with sharp anterior lateral point and some long hairs.

*Elytra* (Fig. 354). Glossy, black with two pairs of small light testaceous maculae; punctures accompanied by a posterior dark spot; hairs dark and recumbent but light and shorter on anterior maculae. Males with rectangular apical notch.

*Wings.* Fully developed.

*Antennae.* Dark testaceous; apical three segments broader; last segment longer than two preceding ones together.



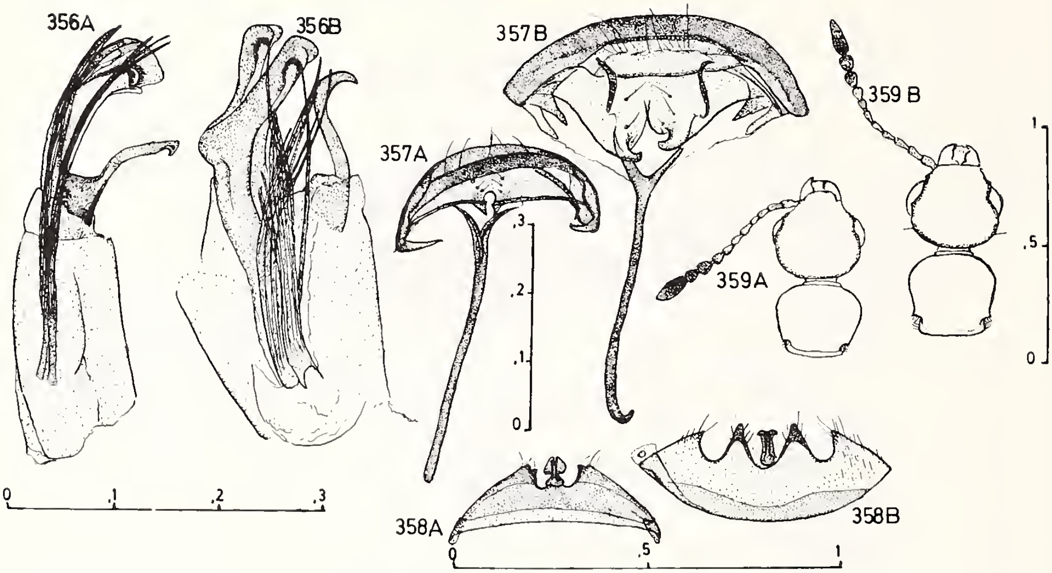
Figs 351–355. *A.* (*A.*) *formicomisternus* spec. nov. 351: sternum of retracted abdominal segment of male. 352: aedeagus, everted. 353: aedeagus, inverted. 354: elytron of male. 355: last exposed abdominal sternum of male.

*Legs.* Dark testaceous, coxae and femora darker.

*Undersurface.* Dark testaceous.

*Male abdomen.* Aedeagus (Fig. 353): median lobe with pointed dorsal apex and ventral subapical forward pointing hook; another slender ventral hook with recurved apex is attached to base of median lobe; on each side of median lobe some thin elongate bars, inconstant in number; in the five dissected specimens two had two bars on each side, two had two on one side and three on the other side and one specimen had two on one side and one on the other side; Fig. 352 shows an aedeagus that was artificially everted; it shows that the ventral hook is attached to base of median lobe but slender bars are not, for one pair has partly everted with median lobe, but the other pair has not; connecting membrane not visible; tegmen lightly sclerotized, basal piece three times as long as apical piece. Retracted segment: tergum narrow with flat apex with some hairs; with many fenestrae not arranged in a row but forming a diffuse transverse band, without definite pattern; sternum (Fig. 351) consists of a pair of well developed triangular plates. Last exposed sternum (Fig. 355) with large apical semi-circular excavation in which stands a median slender process with dorsal margined groove; this resembles the last exposed sternum of several species of the genus *Formicomus* which also have a median process standing in an excavation but then there is no margined groove.

MATERIAL EXAMINED. South Africa: Rustenburg [2527CA], 8.xii.1953, Holotype ♂, Paratype ♂, (A. L. Capener) (AMSA); Pretoria [2528CA], xii.1951, Paratype ♂. (B. Smit) (AMSA); 16 miles west of Pretoria [2527DB], to meloid bait, 26.xii.1953, Paratypes 15 ♂♂, (C. N. Smithers) (AMSA); Nylsvlei near Nylstroom [2428CB], xii.1979, Paratypes 3 ♂♂, (C. Eardley) (AMSA).



Figs 356–359. *A.* (*A.*) *boviei* Pic. (A specimens refer to 'type' specimen; B specimens refer to 'var. prob.' specimen). 356: aedeagus. 357: retracted abdominal segment and spiculum gastrale of male. 358: last exposed abdominal sternum of male. 359: head and prothorax.

*Anthicus (Aulacoderus) boviei* Pic, Figs 356–359
*Anthicus (Aulacoderus) boviei* Pic, 1920: 19

Of this species two specimens were available both from Zaire, Lubumbashi (Elisabethville). One specimen is labelled 'Type', the other 'var. prob.', both in Pic's handwriting. Here the 'Type' is described and the peculiarities of the 'var. prob.' are discussed afterwards. Figs of the two specimens are given side by side in Figs 356–359; the A figs refer to the 'Type', the B figs to the 'var. prob.'.

Size. Length 1,55 mm; width over broadest part of elytra 0,68 mm.

*Head* (Fig. 359A). Glossy, dark testaceous; posterior arch broadly round; punctures fine with fine procumbent hairs. Eyes somewhat bulging.

*Prothorax* (Fig. 359A). Glossy, slightly lighter than head, posterior margin lighter; broader than long, narrower than head; shoulders round; punctures fine with fine recumbent hairs; lateral constrictions at $\frac{5}{6}$ of the length of the prothorax, with few short hairs and connected by a fine transverse dorsal groove.

*Elytra.* Slightly glossy, grey-testaceous; with round shoulders; punctures fine with a dark spot behind each puncture; hairs recumbent, longer than on prothorax; a few semi-erect hairs.

*Wings.* Fully developed.

*Antennae* (Fig. 359A). Testaceous; apical three segments somewhat darker and broader; last segment as long as two preceding ones together.

*Legs.* Testaceous, coxae and femora darker.

*Undersurface.* Testaceous, abdomen darker than thorax.

*Male abdomen.* Aedeagus (Fig. 356A): median lobe with large subapical genital opening with grooved margin; with slender ventral hook with subapical round notch and recurved apex;

at base two structures which split into three long spiny hairs as long as median lobe; connecting membrane not clear; tegmen lightly sclerotized, basal piece four times as long as apical piece. Retracted segment (Fig. 357A): tergum broad, not much arched; with dark transverse line and more distal a number of scattered fenestrae; sternum not subdivided, with a pair of small median proximal hooks. Last exposed sternum (Fig. 358A) with apical indentation with on either side a two-pointed lobe and median process with dorsal margined groove.

The specimen labelled 'var. prob.' is larger than the one labelled 'type' and some of its features are more developed than in 'type'.

Size. Length 1,70 mm; width over broadest part of elytra 0,75 mm.

*Head* (Fig. 359B). Similar to 'type'.

*Prothorax* (Fig. 359B). Slightly longer than 'type' and with the points in front of lateral constrictions better developed.

*Antennae* (Fig. 359B). Slightly longer than 'type', otherwise similar.

*Legs*. Light testaceous, coxae and femora not darker.

*Male abdomen*. Aedeagus (Fig. 356B): median lobe split in two at apex during preparation, each part with half of the genital opening; ventral hook stronger than in 'type' and without subapical notch; basal structures broader and each has at least eight long spiny hairs; tegmen with basal piece twice as long as apical piece. Retracted segment (Fig. 357B) larger than in 'type' and tergum with row of fenestrae. Spiculum gastrale (Fig. 357B) with a pair of slender extra-spicular sclerites, not visible in 'type'. Last exposed sternum (Fig. 358B) with the lateral double apical points well separated with an indentation between the points.

MATERIAL EXAMINED. Congo (now Zaire): Elisabethville (now Lubumbashi) iv.1912, Type ♂, (Bovie) (MNHN); Elisabethville (now Lubumbashi), date x.1911 is crossed out, 1 ♂, var. prob. Pic *vidit*, (Miss. Agric.) (MNHN).

M. Pic may well be right in supposing that the second specimen is a variety of the first or *vice versa*. It would be interesting to investigate a series of this species, preferably from the type locality, to see whether the two forms are continuous.

## SECTION 15

The nine species of this section have the sternum of the retracted abdominal segment of the male developed as a pair of long more or less curved distally pointing spines which articulate with the tergum by means of a separate sclerite. The median lobe of the aedeagus can be extruded from the tegmen by means of the eversion of the connecting membrane (Fig. 390).

The species of this section are very similar with the exception of *A.* (*A.*) *pici* **spec. nov.** which, in contrast to the other species, has no lateral constrictions on the prothorax and has teeth on the connecting membrane of the aedeagus, but not in a dorsal row as in Sections 1–8.

This section corresponds to the Martini Group (van Hille 1961).

Species of this section have been collected in South Africa, Zimbabwe, Tanzania, Sudan and South West Africa.

### Key to the species of Section 15

1 Lateral constrictions of prothorax prominent .................................. 2
— Lateral constrictions of prothorax absent (Fig. 363) ............................ *pici*
2 Last exposed abdominal sternum of male with round apical excavation with median sharp or blunt point (Figs 370, 371 and 379) ................................ 3
— Last exposed abdominal sternum of male with simple round apical excavation ...... 5
3 Median lobe of aedeagus with pointed apical hooks ............................ 4
— Median lobe of aedeagus with blunt slightly inwards curved lobe on either side of genital opening (Fig. 366) ..................................... *orangensis*

4 Median lobe of aedeagus with two pairs of pointed apical hooks (Fig. 375) .... *bomansi*
— Median lobe of aedeagus with one pair of pointed apical hooks (Fig. 376) ....... *citernii*
5 Median lobe of aedeagus very slightly sclerotized, almost membranous (Fig. 381) . *mitis*
— Median lobe of aedeagus well sclerotized .................................... 6
6 Median lobe of aedeagus with blunt inwards curved lobe on either side of genital opening (Fig. 385) ................................................ *denticollis*
— Median lobe of aedeagus not with inwards curved lobes ........................ 7
7 Median lobe of aedeagus with pair of straight pointed apical lobes (Fig. 389) .... *martini*
— Median lobe of aedeagus with a pair of blunt lobes ............................ 8
8 Tergum of retracted abdominal segment of male with flat apex (Fig. 396) ..... *hobohmi*
— Tergum of retracted abdominal segment of male with bluntly pointed apex (Fig. 400) ........................................................................ *medleri*

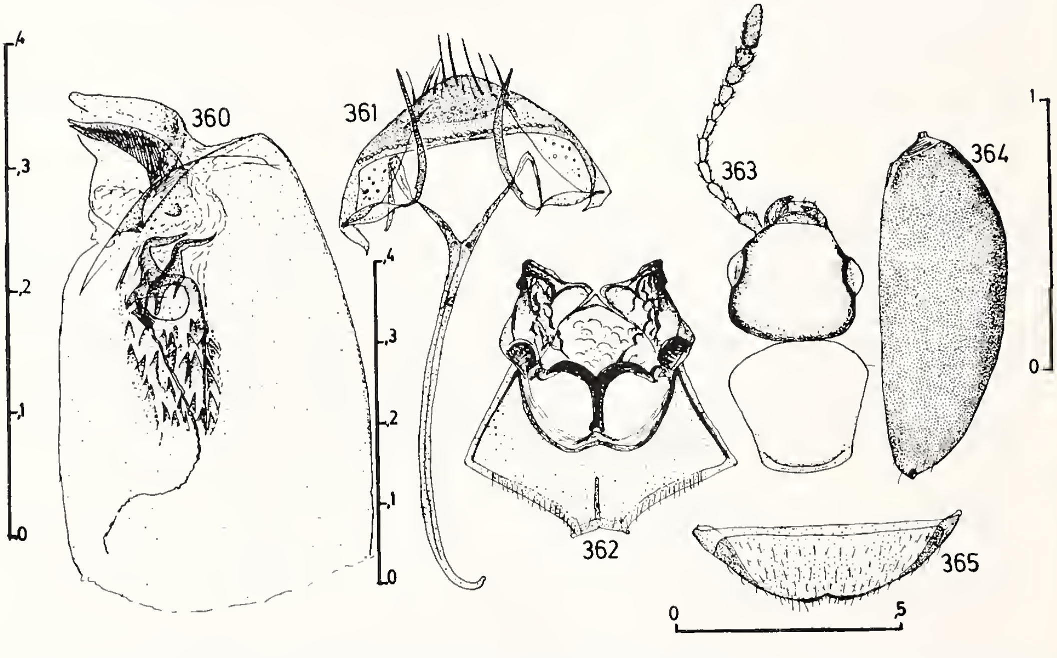
*Anthicus (Aulacoderus) pici* **spec. nov.**, Figs 360–365

Size. Length 2,25 mm (2,12–2,38); width over broadest part of elytra 0,76 mm (0,70–0,82).

*Head* (Fig. 363). Glossy, black; posterior arch broad with round angles to eyes; punctures fine with short procumbent hairs. Eyes bulging.

*Prothorax* (Fig. 363). Glossy, very dark testaceous to black; broader than long, broader than head; shoulders round; punctures closer than on head, especially on the anterior area, with short recumbent hairs; lateral constrictions Absent but base with narrow margin.

*Elytra* (Fig. 364). Glossy, black; without shoulders; with fine punctures, less close than on



Figs 360–365. *A.* (*A.*) *pici* spec. nov. 360: aedeagus. 361: retracted abdominal segment and spiculum gastrale of male. 362: meso- and metathoracic sterna. 363: head and prothorax. 364: elytron of male. 365: last exposed abdominal sternum of male.

prothorax, with fine recumbent hairs longer than on prothorax; male with small apical point and short notch.

*Wings*. Absent.

*Antennae* (Fig. 363). Dark testaceous, apical 3–4 segments gradually thicker and slightly darker; last segment as long as two preceding ones together.

*Legs*. Testaceous, coxae and femora slightly darker.

*Undersurface*. Dark testaceous, abdomen darker than thorax; each mesepimeron has a round sclerotized swelling with 3–4 integumental ingrowths from top to base (Fig. 362).

*Male abdomen*. Aedeagus (Fig. 360) short and broad: median lobe with a pair of apical dorsally pointing sclerotized hooks; between the basal struts of these hooks lies a short tube with striated wall ending in genital opening; connecting membrane with a number of soft dark apically pointing teeth, not arranged in a definite pattern; tegmen with long broad basal piece and short apical piece; in the region of apical piece are two finely striated wing-like processes. Retracted segment (Fig 361): tergum with bluntly pointed apex and transverse row of fenestrae; sternum consists of a pair of distally pointing spines, connected to the base of tergum by a pair of thin narrow plates. Spiculum gastrale (Fig. 361) with long stem and short Y-arms. Last exposed sternum (Fig. 365) with slightly indented apex.

MATERIAL EXAMINED. South West Africa: Okahandja [2116DD], 1.ii.1928, Holotype ♂, Paratype ♀, (R. E. Turner) (BMNH).

*Anthicus (Aulacoderus) orangensis* **spec. nov.**, Figs 366–370

Size. Length 2,27 mm (2,07–2,57); width over broadest part of elytra 0,74 mm (0,67–0,85).

*Head* (Fig. 369). Not glossy but finely chagrinated, dark testaceous; posterior arch broadly round; punctures very fine with short dark procumbent hairs. Eyes somewhat bulging.

*Prothorax* (Fig. 369). Slightly glossy, testaceous, lighter than head; slightly longer than broad, narrower than head; shoulders round; punctures very fine with short recumbent hairs; lateral constrictions at $\frac{3}{4}$ of the length of the prothorax, with some hairy covering but hairs are not very long or numerous.

*Elytra* (Fig. 368). Elongate, testaceous with dark transverse band behind middle and a less dark apical and shoulder area; the darker pigmentation may extend along median suture and lateral margins so that two pairs of lighter maculae are formed but in many specimens the light areas form transverse bands, especially the anterior one; punctures distinct with recumbent hairs which have the colour of the area on which they are implanted.

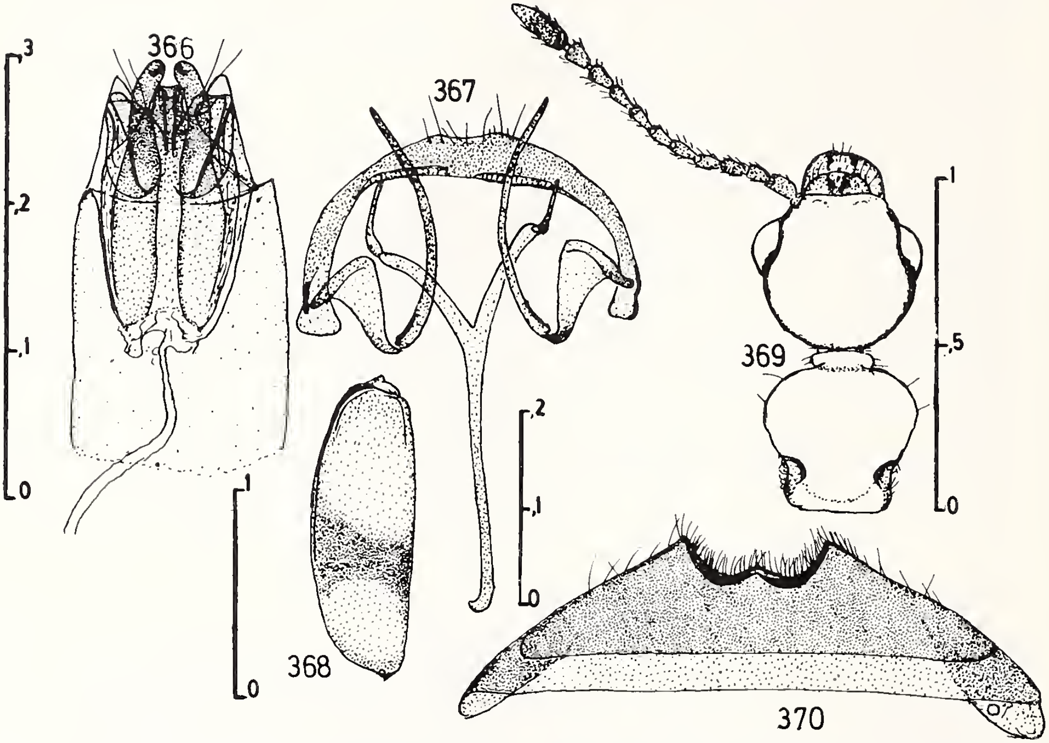
*Wings*. Fully developed.

*Antennae* (Fig. 369). Testaceous, only the proximal half of the last segment is darker; apical five segments only slightly broader; last segment slightly longer than two preceding ones together.

*Legs*. Testaceous.

*Undersurface*. Testaceous, abdomen darker than thorax.

*Male abdomen*. Aedeagus (Fig. 366): median lobe with a pair of blunt lobes, somewhat curved inwards at apex; median part with genital opening shorter than these lobes; connecting membrane unarmed; tegmen lightly sclerotized, basal piece more than twice as long as apical piece. Retracted segment (Fig. 367): tergum semi-circular, truncate at apex; row of fenestrae basal and interrupted in middle; sternum consists of pair of triangular plates articulating with a pair of curved distally pointing spines. Last exposed sternum (Fig. 370) with apical hairy indentation with small median point.



Figs 366–370. *A.* (*A.*) *orangensis* spec. nov. 366: aedeagus. 367: retracted abdominal segment and spiculum gastrale of male. 369: head and prothorax. 370: last exposed abdominal sternum of male.

Material examined. South Africa: Van der Kloof [2924DD], along P. K. le Roux Dam and in nearby Rolfontein Nature Reserve, to meloid bait, xi-xii.1978, Holotype ♂, Paratypes 23 ♂♂, (J. C. van Hille) (AMSA).

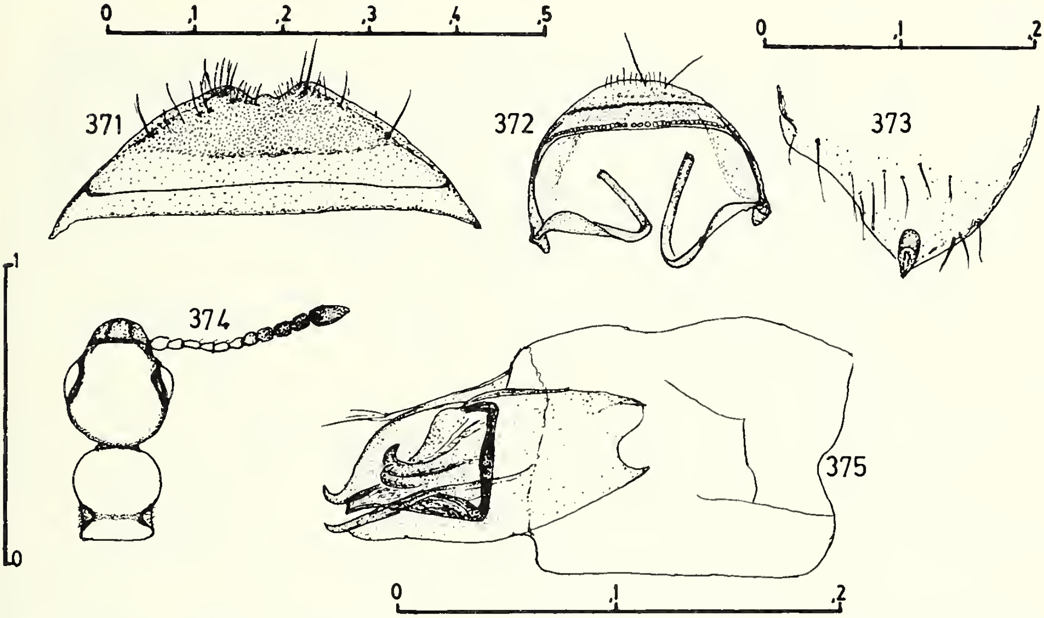
This species was collected together with *A. (A.) martini* but in smaller numbers, about 1:10. The two species are similar in size and shape but *A. (A.) orangensis* is darker.

*Anthicus (Aulacoderus) bomansi* **spec. nov.,** Figs 371–375

Size. Length 1,75 mm (1,64–1,80); width over broadest part of elytra 0,63 mm (0,60–0,75).

*Head* (Fig. 374). Glossy, dark testaceous to black; posterior arch broadly round; with fine and well-spaced punctures and fine procumbent hairs. Eyes slightly bulging.

*Prothorax* (Fig. 374). Glossy, same colour as head; longer than broad, narrower than head; shoulders round; with fine punctures and fine silvery-grey recumbent hairs; lateral constrictions at $\frac{3}{4}$ of the length of the prothorax, with short hairs and connected by a shallow dorsal depression.



Figs 371–375. *A.* (*A.*) *bomansi* spec. nov. 371: last exposed abdominal sternum of male. 372: retracted abdominal segment of male with tips of spikes of sternum broken off. 373: elytron of male. 374: head and prothorax. 375: aedeagus.

*Elytra.* Glossy, somewhat lighter than prothorax; elongate and not much sclerotized; with fine punctures and recumbent hairs, longer than on prothorax; in male narrowed to the apical point with notch.

*Wings.* Fully developed.

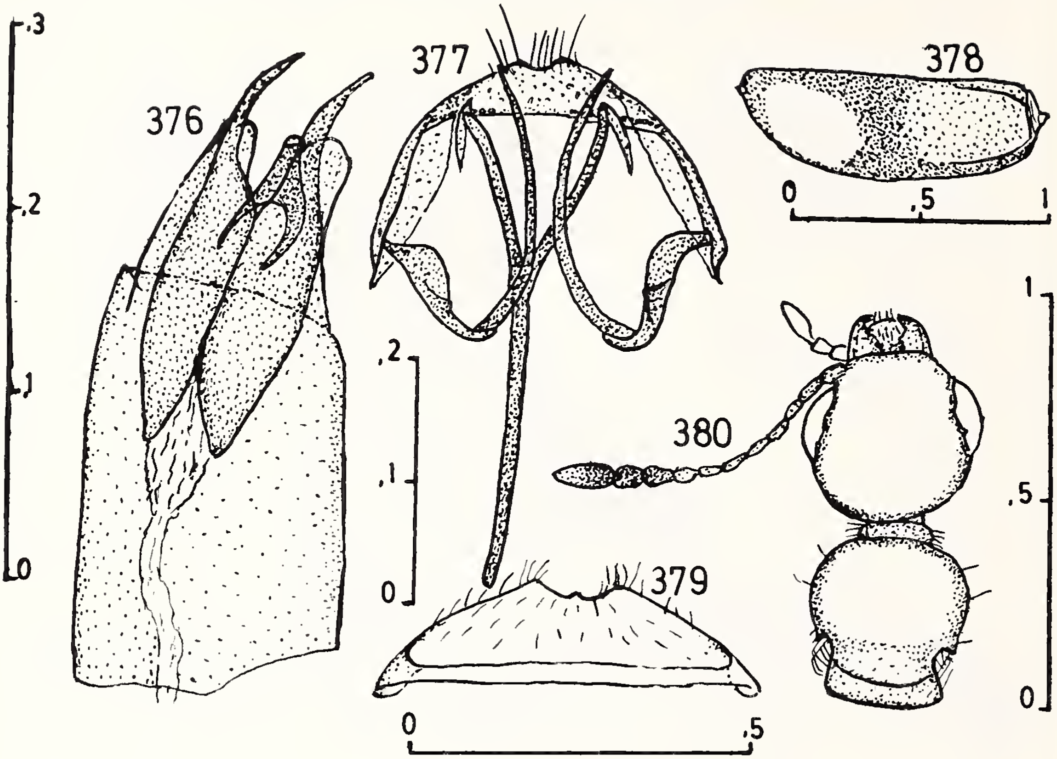
*Antennae* (Fig. 374). Light testaceous; rather short; apical 4–5 segments somewhat darker and broader; last segment slightly longer than two preceding ones together.

*Legs.* Light testaceous, femora and tibiae darker.

*Undersurface.* Dark testaceous.

*Male abdomen.* Aedeagus (Fig. 375): median lobe short and broad, with two pairs of recurved hooks ending proximally and distally of the genital opening respectively; connecting membrane unarmed; tegmen: basal piece almost three times as long as apical piece, lightly sclerotized. Retracted segment (Fig. 372): tergum with round apex and proximal row of fenestrae, transverse dark line between apex and row of fenestrae; sternum consists of pair of very narrow triangular sclerites each articulating with distally pointing spine; in the first dissected specimens the points of these spines had broken off and the break had not happened during the preparation; in another dissected specimen the spines were complete and similar to those of *A. (A.) martini* (Fig. 392). Last exposed sternum (Fig. 371) apically excavated with small median prominence.

MATERIAL EXAMINED. Tanganyika (now Tanzania): Moba 780 m, to light, iv.1953, Holotype ♂, Paratypes 5, (N. Bomans) (MRAC).



Figs 376–380. *A.* (*A.*) *citernii* Pic. 376: aedeagus. 377: retracted abdominal segment and spiculum gastrale of male. 378: elytron of male. 379: last exposed abdominal sternum of male. 380: head and prothorax.

*Anthicus (Aulacoderus) citernii* Pic, Figs 376–380
*Anthicus (Aulacoderus) citernii* Pic, 1904: 92

Size. Length 2,26 mm (2,00–2,51); width over broadest part of elytra 0,80 mm (0,72–0,92).

*Head* (Fig. 380). Glossy, light to dark testaceous; posterior arch somewhat broadly round; punctures minute with fine procumbent hairs. Eyes darkly margined and bulging.

*Prothorax* (Fig. 380). Lighter than head, with lighter base; longer than broad, narrower than head; collar laterally hairy; shoulders round; punctures fine with short light recumbent hairs; lateral constrictions at ⅔ of length of prothorax, well supplied with hairs and with a small lateral tooth at the anterior margin.

*Elytra* (Fig. 378). Glossy, light to dark testaceous with dark transverse band in the middle extending backwards along the median suture almost to apex, leaving a pair of subapical lighter maculae; the apical and shoulder areas are somewhat darker in some specimens but in the regressively coloured specimens the dark markings are reduced and vague; punctures more distinct than on prothorax, with recumbent hairs and some erect or semi-erect hairs.

*Wings*. Fully developed.

*Antennae* (Fig. 380). Slender, testaceous, the three apical segments broader and darker but in some specimens only the last segment is darker; last segment as long as the two preceding ones together.

*Legs*. Light testaceous, coxae and femora may be darker.

*Undersurface*. Testaceous, abdomen darker than thorax.

*Male abdomen*. Aedeagus (Fig. 376): median lobe with round genital opening at the apex of short sclerotized triangular structure, with curved pointed spine on each side of genital opening and a pair of shorter soft lobes with blunt spines; connecting membrane unarmed; tegmen very lightly sclerotized, apical piece has membranous pointed dorsal apex with fine hairs; basal piece twice as long as apical piece. Retracted segment (Fig. 377): tergum lightly sclerotized with flat or slightly indented hairy apex and proximal row of fenestrae interrupted in middle; sternum consists of a pair of narrow triangular plates articulating with a pair of curved distally pointing spikes. Spiculum gastrale Y-shaped and rather short with pair of narrow extraspicular sclerites. Last exposed sternum with apical indentation and small median prominence (Fig. 379).

MATERIAL EXAMINED. Eritrea: Sitet el Eghin, ii.1906, 1 ♂, Pic det., (D. Figini) (MSNG). Kenya: Turkana, partie sud, sables 800–1 000 m, 1 ♀, (Mission de l'Omo 1932–1933, Arambourg, Chappuis et Jeannel) (MNHN). Sudan: Ed Damer, Hulelba, 8.iii.1962, 1 ♀, Bonadona det., (R. Remane) (ZSBM); Govt. Lubia, Mang Prov., at night from sheet, 8.i.1934, 1 ♂, (Miss M. Steele) (BMNH).

The last specimen is labelled '*sulcicollis* Pic??, det. R. F. Heberdey'. *A. (Aulacoderus) sulcicollis* Pic (1895c) is described from Iran and Afghanistan. The author has only seen a female Type of this species from Afghanistan (MNHN). It seems to the author that this specimen has a broader head, more sloping shoulders and lateral constrictions closer to the base of the prothorax than the specimens of *A.* (*A.*) *citernii*. Its colour is rather dark but falls within the range of colour variations of the *A.* (*A.*) *citernii* specimens. The localities of the two species are far apart and on the whole the species of this section have small areas of distribution. Only a male specimen from the type locality of *A.* (*A.*) *sulcicollis* would allow a conclusion whether these two names are synonyms.

*Anthicus (Aulacoderus) mitis* **spec. nov.**, Figs 381–384

Size. Length 2,05 mm; width over broadest part of elytra 0,75 mm.

*Head*. Glossy, dark testaceous; posterior arch round; punctures fine with fine procumbent hairs. Eyes with dark margin, hardly bulging.

*Prothorax*. Glossy, slightly lighter than head; longer than broad, narrower than head; shoulders round; with very fine and sparse punctures with fine recumbent hairs; lateral constrictions at ¾ of the length of the prothorax, with short hairs.

*Elytra*. Glossy, lighter than prothorax with two pairs of vague maculae, the anterior pair on anterior half, the posterior pair near apex; shoulders not prominent; punctures coarser and hairs longer than on prothorax.

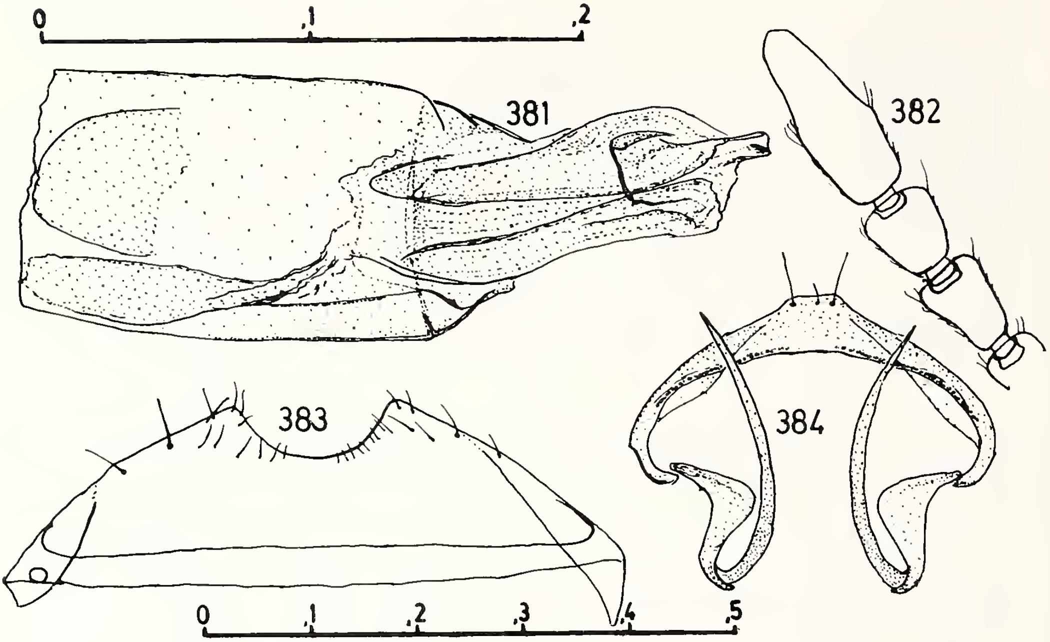
*Wings*. Full size but very flimsy.

*Antennae*. Light testaceous, slightly broader and darker at apex; last segment (Fig. 382) with somewhat angular outline and slightly longer than two preceding ones together.

*Legs*. Light testaceous, distal half of femora slightly darker.

*Undersurface*. Testaceous.

*Male abdomen*. Aedeagus (Fig. 381): median lobe short and membranous; genital opening terminal without lateral lobes or hooks; connecting membrane unarmed; tegmen with basal piece more than twice as long as apical piece. Retracted segment (Fig. 384): tergum narrow, with row of fenestrae interrupted in middle; sternum consisting of pair of triangular plates with distally pointing spikes. Last exposed sternum (Fig. 383) with broad semi-circular indentation.



Figs 381–384. *A.* (*A.*) *mitis* spec. nov. 381: aedeagus. 382: apex of antenna. 383: last exposed abdominal sternum of male. 384: retracted abdominal segment of male.

Material Examined. South Africa: Matjesfontein [3330BA], 1–18.xii.1928, Holotype ♂, (R. E. Turner) (BMNH).

*Anthicus (Aulacoderus) denticollis* **spec. nov.**, Figs 385–388

Size. Length 2,24 mm (1,87–2,60); width over broadest part of elytra 0,83 mm (0,78–0,87).

*Head* (Fig. 387). Moderately glossy, testaceous; ovoid in shape; posterior arch broadly round; punctures fine and sparse with very fine procumbent hairs. Eyes large and bulging.

*Prothorax* (Fig. 387). Glossy testaceous; longer than broad, narrower than head; round in front; with fine punctures with very fine recumbent hairs and a few erect hairs; lateral constrictions at $\frac{3}{5}$ of the length of the prothorax, with sharp tooth in front of constrictions; constrictions with fine long hairs.

*Elytra* (Fig. 388). With two light areas alternating with three darker areas of which the middle one is darkest; punctures fine but darkly marked on dark areas; hairs recumbent.

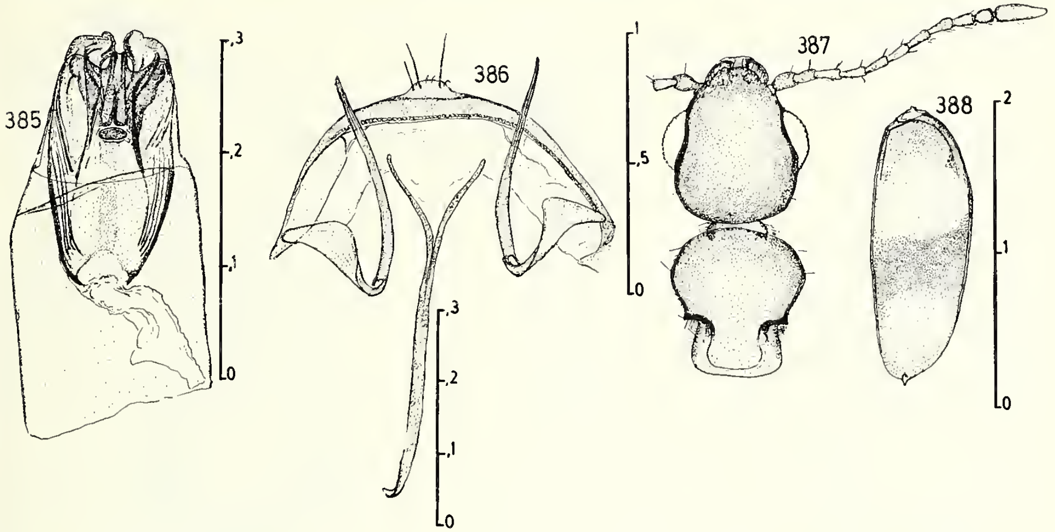
*Wings*. Fully developed.

*Antennae* (Fig. 387). Light testaceous, not darker and hardly broader at apex; last segment longer than two preceding ones together.

*Legs*. Light testaceous.

*Undersurface*. Testaceous, thorax lighter than abdomen.

*Male abdomen*. Aedeagus (Fig. 385): median lobe is a short sclerotized tube with apical genital opening and a blunt short lobe on each side; lateral to these lobes a pair of slightly



Figs 385–388. *A.* (*A.*) *denticollis* spec. nov. 385: aedeagus. 386: retracted abdominal segment and spiculum gastrale of male. 387: head and prothorax. 388: elytron of male.

longer lobes, each with round inwards pointing apex; connecting membrane unarmed; tegmen little sclerotized and not pigmented, basal piece longer than apical piece. Retracted segment (Fig. 386): tergum narrow with proximal row of fenestrae; sternum consisting of pair of triangular sclerites each articulating with long distally pointing spike. Last exposed sternum with shallow apical indentation.

Material examined. South West Africa: Bezirk Omaruru, Farm Okosongoro [2115BD], 9.xi.1932, Holotype ♂, (Dr H. Thomsen) (NMW); Bezirk Otjiwarongo, Farm Okosingomongo [2016BC], 9.x.1933, Paratype ♂, (Dr H. Thomsen) (NMW).

Holotype and Paratype are labelled '*A. denticollis* nov. det. R. F. Heberdey'. Name and description were never published.

In addition there is a single ♀ from the same locality and collected on the same day as the holotype; it is dark testaceous all over and has no elytral pattern. It is labelled 'ab.'. The author is not sure that this specimen belongs to the same species as the two males.

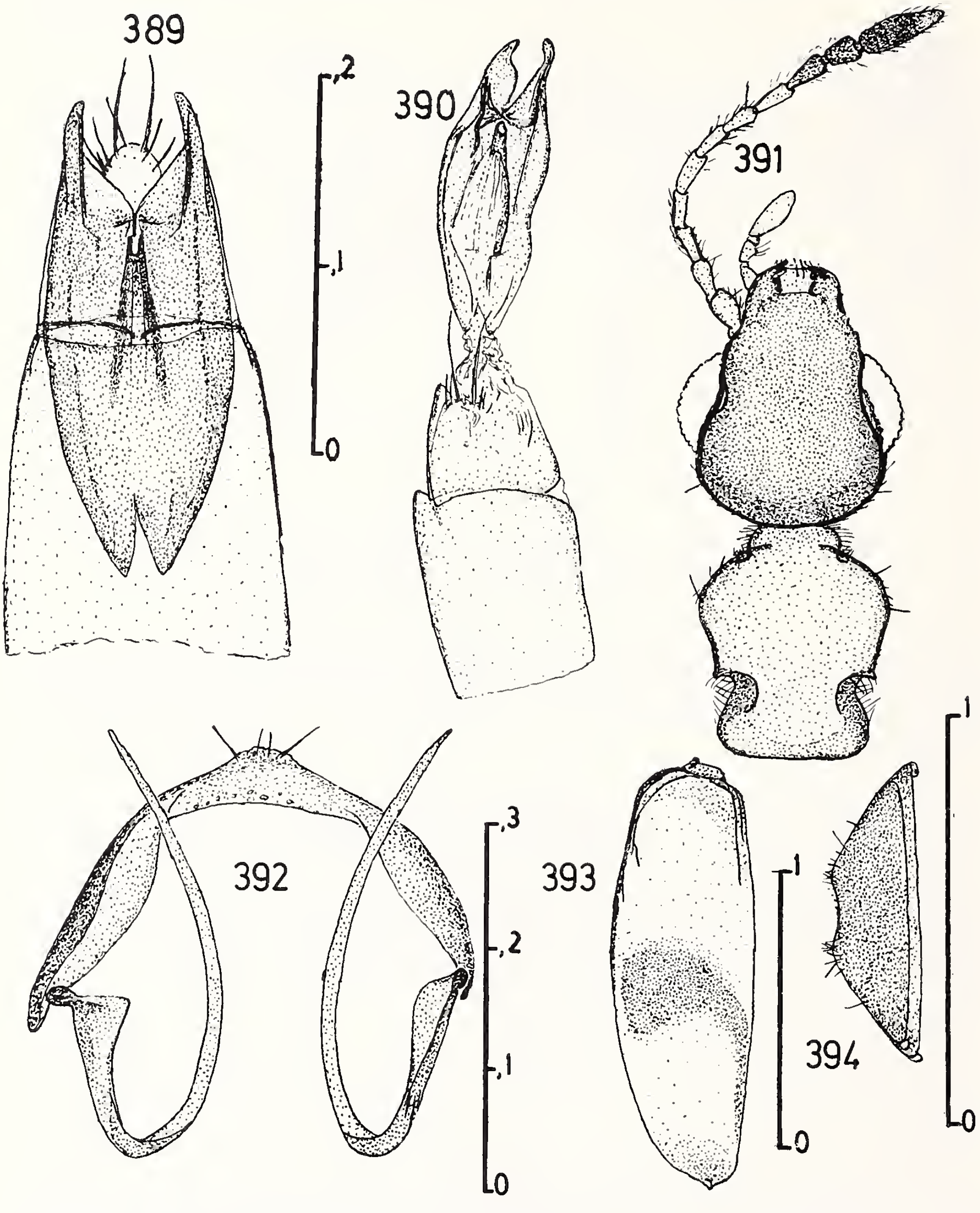
*Anthicus (Aulacoderus) martini* Pic, Figs 389–394

*Anthicus (Aulacoderus) martini* Pic, 1897b: 170

Size. Length 2,30 mm (1,92–2,61); width over broadest part of elytra 0,81 mm (0,66–0,90).

*Head* (Fig. 391). Glossy, testaceous to dark testaceous; posterior arch broadly round; punctures fine with fine procumbent hairs. Eyes large and bulging.

*Prothorax* (Fig. 391). Rather glossy, testaceous; longer than broad, longer than head; round in front; punctures fine with fine recumbent hairs, slightly shorter than on head; lateral constrictions at $\frac{3}{5}$ of the length of the prothorax, filled with fine long hairs and with lateral tooth anterior to constrictions.



Figs 389–394: *A.* (*A.*) *martini* Pic. 389: aedeagus, inverted. 390: aedeagus, everted. 391: head and prothorax. 392: retracted abdominal segment of male. 393: elytron of male. 394: last exposed abdominal sternum of male.

*Elytra* (Fig. 393). Glossy, light testaceous with curved dark band in middle, which does not reach lateral margin and is continued backward along median suture; dark areas at base and apex are variable and may be absent; hairs fine and recumbent, longer than on prothorax; with some erect hairs especially along posterior half of lateral margin.

*Wings*. Fully developed.

*Antennae* (Fig. 391). Slender, testaceous, apical two or three segments darker but hardly broader; last segment longer than two preceding ones together.

*Legs*. Testaceous.

*Undersurface*. Testaceous, abdomen darker than thorax.

*Male abdomen*. Aedeagus (Fig. 389): median lobe oval, with blunt claw on each side of genital opening which is small and without beaded margin; median lobe can protrude beyond tegmen (Fig. 390) by the eversion of connecting membrane which is unarmed; tegmen lightly sclerotized with apical piece shorter than basal piece. Retracted segment (Fig. 392): tergum narrow, with transverse row of very small fenestrae which are scattered in median area; sternum consisting of a pair of narrow triangular sclerites articulating with long distally pointing spikes. Last exposed sternum (Fig. 394) with shallow apical indentation.

MATERIAL EXAMINED. South Africa: Beaufort West [3222BC], no date, 1 ♂, Pic det., (Dr Martin) (AMSA); Vaal near Kimberley, Nooitgedacht [2824DB], xi.1945, 4 ♂♂, (J. H. Power) (AMSA); Vaal near Barkley West [2824DA], to meloid bait, xii.1948, 34 ♂♂, (R. J. B. Power) (AMSA); N. W. Cape Province, Richtersveld, Rosyntjieberg [2827AC], by light-trap, 11.x.1974, 19 ♂♂, 7 ♀♀, (M. W. Mansell) (AMSA); Van der Kloof, P. K. le Roux Dam and Rolfontein Nature Reserve [2924DD], to meloid bait, xi–xii.1978, 300 ♂♂, (J. C. van Hille) (AMSA); N. Cape Province, Witsand Farm [2822DA], 2–4.ii.1979, 6 ♂♂, (Lamoral, Bampton and Barnley) (AMSA). South West Africa: Aus [2628CB], xi.1929, 1 ♂, (R. E. Turner) (AMSA).

### *Anthicus (Aulacoderus) hobohmi* **spec. nov.**, Figs 395–398

Size. Length 2,51 mm (2,35–2,68); width over broadest part of elytra 0,85 mm (0,76–0,91).

*Head* (Fig. 397). Mat, chagrinated, dark testaceous; posterior arch broadly round; punctures very fine, hardly visible, with fine short procumbent hairs. Eyes large and bulging.

*Prothorax* (Fig. 397). Mat, as dark as head or slightly lighter; longer than broad, narrower than head; punctures not quite as fine as on head, with fine short recumbent hairs; shoulders bluntly angular; lateral constrictions prominent at $\frac{2}{3}$ of the length of the prothorax.

*Elytra*. Glossy, testaceous to dark testaceous, without pattern; elongate with well developed shoulders; punctures distinct with fine light short recumbent hairs.

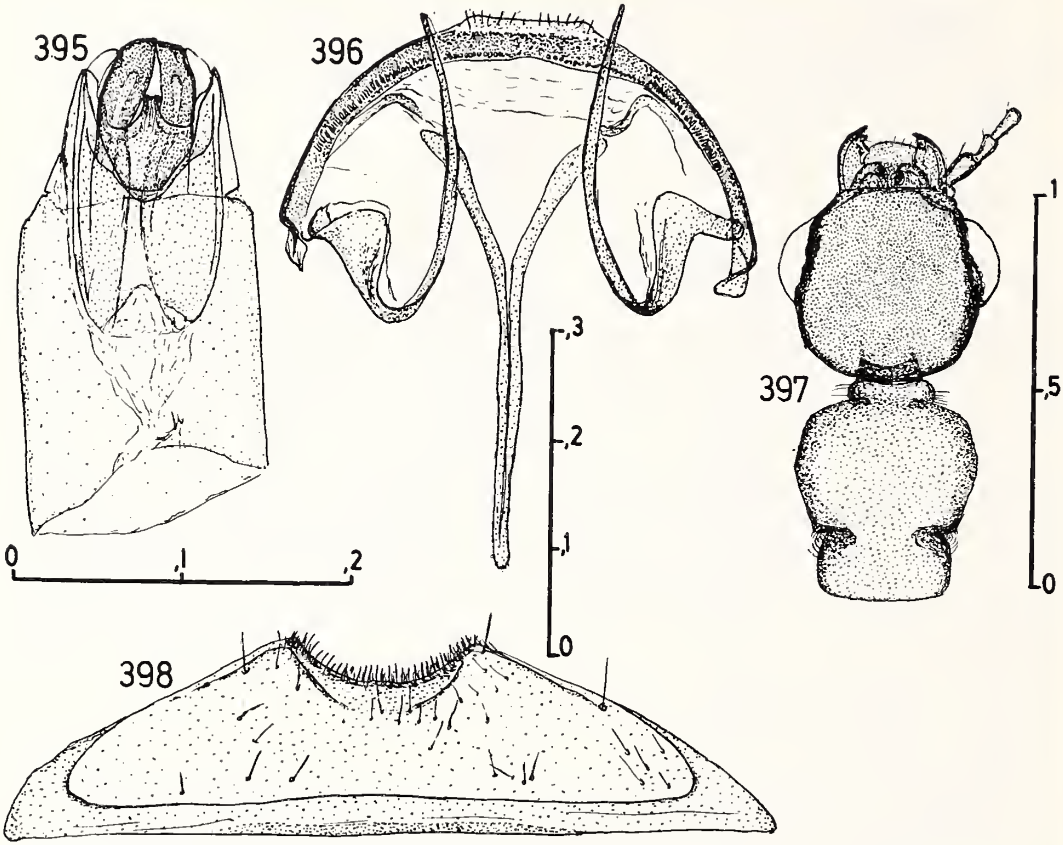
*Wings*. Fully developed.

*Antennae*. Testaceous, apical five segments slightly darker and little broader; last segment longer than two preceding ones together.

*Undersurface*. Dark testaceous.

*Male abdomen*. Aedeagus (Fig. 395): median lobe with genital opening at end of short tube with on either side a broad blunt pigmented lobe; lateral to these a pair of unpigmented more slender blunt lobes; connecting membrane unarmed; tegmen with basal piece about twice as long as apical piece. Retracted segment (Fig. 396): tergum semi-circular, apically broadly truncate, with transverse row of fenestrae; sternum consisting of pair of thin triangular plates articulating with a pair of distally pointing spikes. Last exposed sternum (Fig. 398) with broad apical indentation with short close hairs.

MATERIAL EXAMINED. South West Africa: Abachaus, xii.1946, Holotype ♂, Paratypes 4 ♂♂, (G. Hobohm) (AMSA).



Figs 395–398. *A.* (*A.*) *hobohmi* spec. nov. 395: aedeagus. 396: retracted abdominal segment and spiculum gastrale of male. 397: head and prothorax. 398: last exposed abdominal sternum of male.

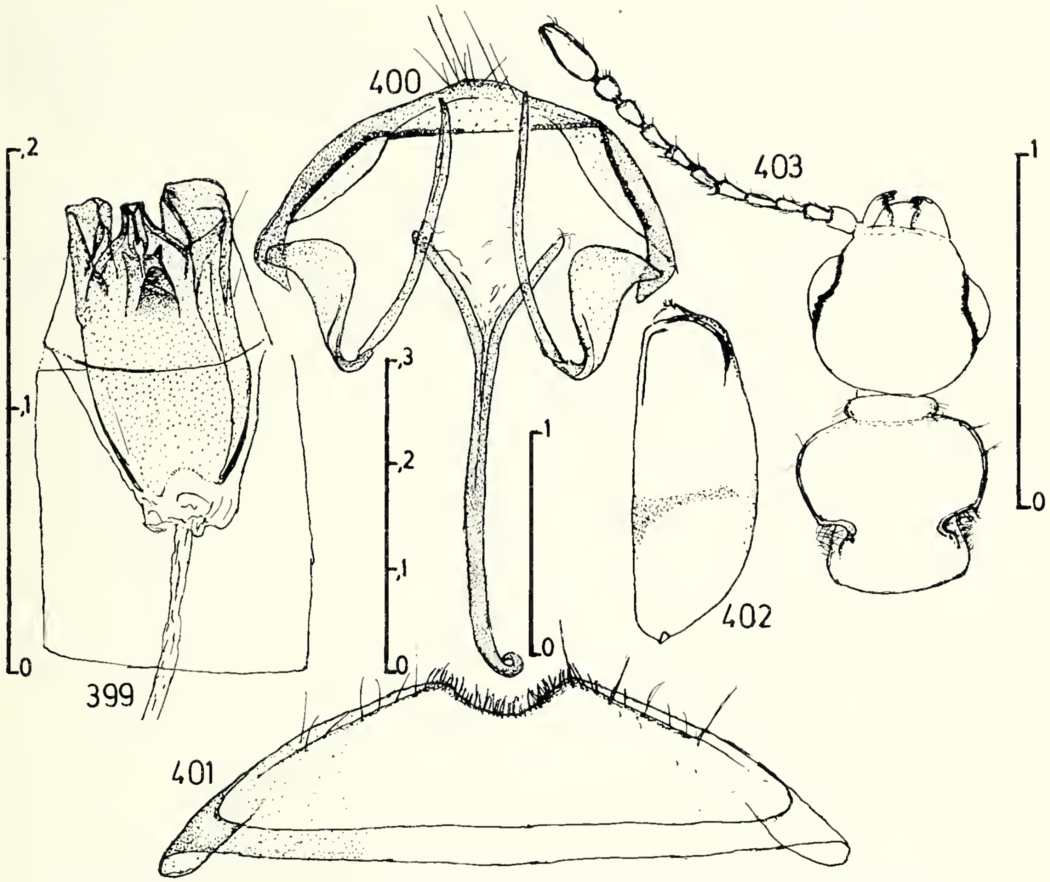
*Anthicus* (*Aulacoderus*) *medleri* **spec. nov.**, Figs 399–403

Size. Length 2,27 mm (2,20–2,33); width over broadest part of elytra 0,81 mm (0,72–0,87).

*Head* (Fig. 403). Moderately glossy, testaceous; posterior arch broadly round; punctures very fine with fine short procumbent hairs. Eyes with black margin, rather large, not much bulging.

*Prothorax* (Fig. 403). Moderately glossy, testaceous; longer than broad, broader than head; shoulders round with two pairs of lateral erect hairs; punctures very fine with short recumbent hairs; lateral constrictions at $\frac{3}{4}$ of the length of the prothorax, well developed and hairy.

*Elytra* (Fig. 402). Testaceous, with narrow transverse dark band behind the middle, broad at median suture, narrow at lateral margins; punctures larger and hairs coarser than on prothorax.



Figs 399–403. *A.* (*A.*) *medleri* spec. nov. 399: aedeagus. 400: retracted abdominal segment and spiculum gastrale of male. 401: last exposed abdominal sternum of male. 402: elytron of male. 403: head and prothorax.

*Wings*. Fully developed.

*Antennae*. Light testaceous; apical three segments slightly broader but not darker; last segment longer than two preceding ones together.

*Maxillary palps* and *legs*. Light testaceous.

*Undersurface*. Testaceous.

*Male abdomen*. Aedeagus (Fig. 399): median lobe short and broad; genital opening at apex of triangular structure with on each side a slightly longer truncate lobe; proximal to genital opening lies a dark asymmetrical structure; connecting membrane unarmed; tegmen little sclerotized and not pigmented; apical piece with some long apical hairs, about half the length of basal piece. Retracted segment (Fig. 400): tergum with transverse row of fenestrae interrupted in middle; sternum consisting of a pair of triangular sclerites articulating with a pair of distally pointing spikes. Last exposed sternum (Fig. 401) with apical indentation with a fringe of close hairs.

Material examined. Nigeria: Serti, N. E. State, 29.iii.1970, Holotype ♂, (J. T. Medler) (AMSA). Congo (now Zaire): Parc national Garamba, à la lampe, 4.ii.1951, 1 ♀, (J. Verschuren) (MRAC); Parc national Garamba, Graminées sous des arbres, fauchage, à une tête de source, 22.ii.1951, 1 ♂, (J. Verschuren) (MRAC); Parc national Garamba, Galerie forestière, fauchage, taillis ombragés, 19.i.1951, 1 ♂, (H. de Saeger) (MRAC).

## SECTION 16

The species of this section form the Flavopictus Group (van Hille 1961). The species resemble each other in many respects and are closely related. The structure of the aedeagus is uniform and quite different from that of the species of the preceding sections.

The median lobe of the aedeagus is membranous and can slide up and down in the tegmen (Fig. 404); it has an oval genital opening. Proximal to the genital opening lies a short slender

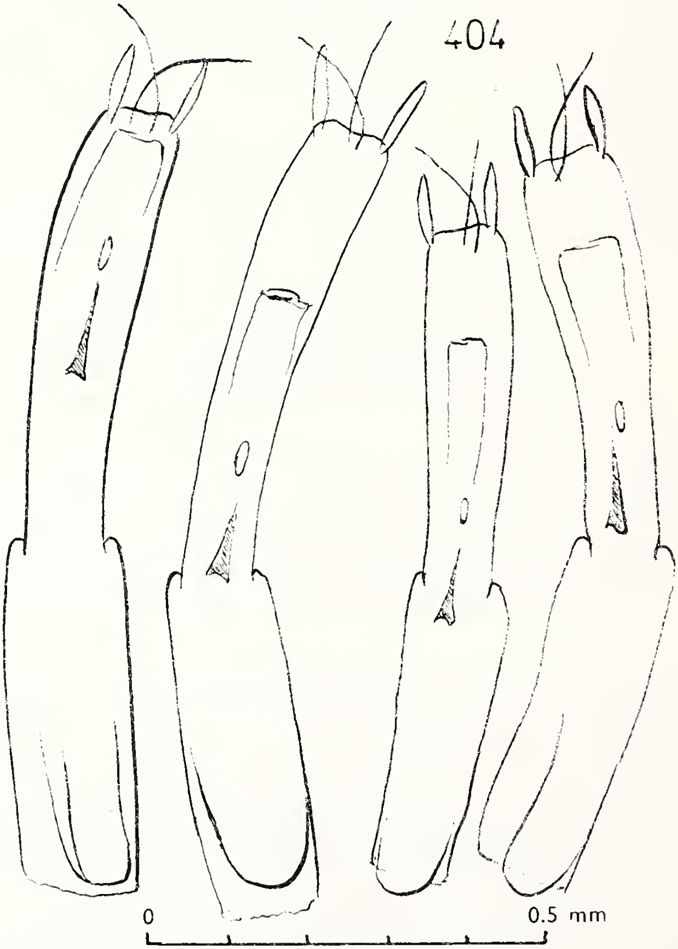


Fig. 404. *A.* (*A.*) *poweri* van Hille. 404: four different aedeagi showing various positions of median lobe in tegmen.

bar, the only sclerotized part of the median lobe. The bar has a pointed apex and a slightly broader base which in some species is shortly forked. The base of the median lobe is surrounded by the connecting membrane which in most species has fine pustules. The attachment of the connecting membrane to the tegmen is not visible in the preparations.

Of the seven species of this section four occur in South Africa, one in Zimbabwe, one in Lebanon and one in Algeria and Morocco.

### Key to the species of Section 16

1 Apex of tegmen of aedeagus flat or concave .................................... 2
— Apex of tegmen of aedeagus convex .................................... 4
2 Apex of tegmen of aedeagus concave with four blunt spines of different length on each side (Fig. 405) .................................... *lutopictus*
— Apex of tegmen of aedeagus flat .................................... 3
3 Tegmen of aedeagus with apical fringe of about 20 dark hairs (Fig. 410) ....... *manselli*
— Tegmen of aedeagus with an apical lateral spine on each side (Fig. 413) ......... *poweri*
4 Tegmen of aedeagus with two apical or subapical spines on each side ............. 6
— Tegmen of aedeagus with more than two apical or subapical spines on each side .... 5
5 Tegmen of aedeagus with four apical or subapical sharp light spines on each side (Fig. 420) .................................... *lovemorei*
— Tegmen of aedeagus with about seven apical or subapical spines on each side (Fig. 422) .................................... *coarcticollis*
6 Apical spines of tegmen of aedeagus stout and dark (Fig. 425) ............. *flavopictus*
— Apical spines of tegmen of aedeagus thin and light (Fig. 428) ............... *vaulogeri*

*Anthicus (Aulacoderus) lutopictus* van Hille, Figs 405–409
*Anthicus (Aulacoderus) lutopictus* van Hille, 1961: 236–239

Size. Length 2,55 mm (2,20–3,50); width over broadest part of elytra 0,86 mm (0,75–1,10).

*Head*. Testaceous to dark testaceous; elongate; posterior arch round, narrowing from eyes to mouthparts; rather closely punctured with short whitish procumbent hairs. Eyes large and bulging.

*Prothorax*. Glossy, testaceous to dark testaceous; longer than broad, as broad as head; shoulders round; punctures fine with short whitish recumbent hairs; with prominent lateral constrictions at $\frac{2}{3}$ of the length of the prothorax, connected by a hairy dorsal groove.

*Elytra* (Fig. 408). Light testaceous to testaceous, with dark band at shoulder area and another dark band behind the middle, often not reaching the lateral margins; in some specimens also the apex is dark; the dark areas vary in extent and intensity; less closely punctured and less hairy than prothorax.

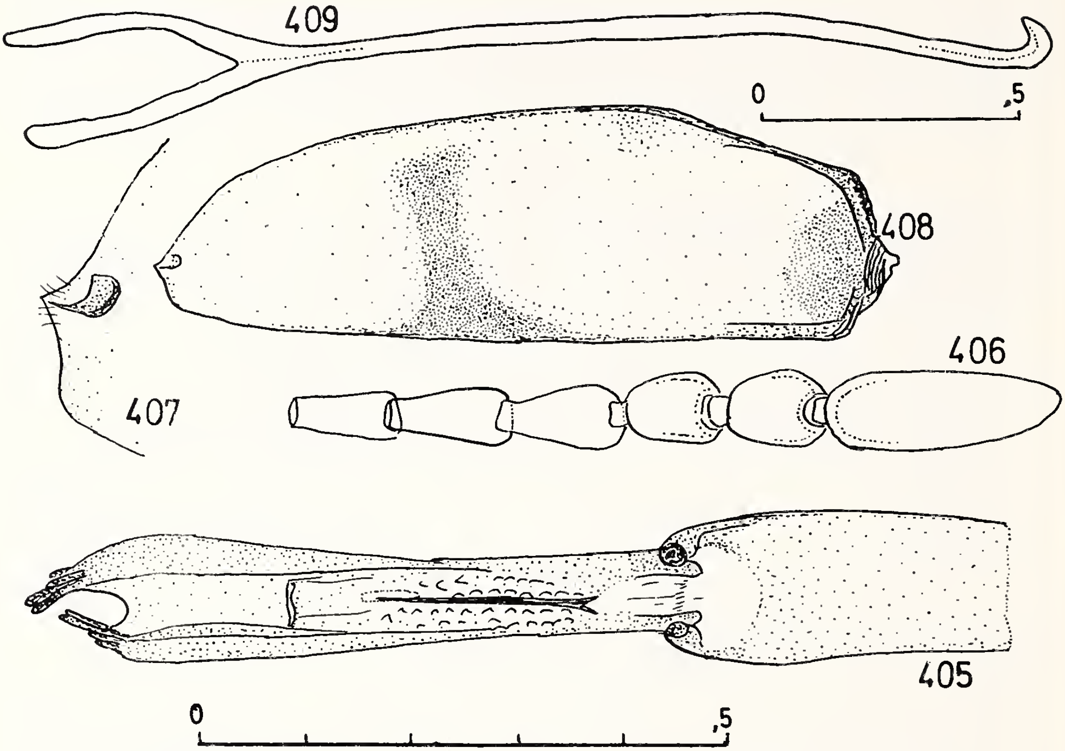
*Wings*. Fully developed.

*Antennae*. Light testaceous, apical segments hardly broader and not darker; last segment (Fig. 406) longer than two preceding ones together.

*Legs*. Light testaceous.

*Undersurface*. Testaceous.

*Male abdomen*. Aedeagus (Fig. 405): median lobe membranous with slender arrow-shaped sclerotized longitudinal bar of which pointed apex lies at level of narrow oval genital opening which has finely beaded margin; the bar is shortly forked at proximal end; connecting membrane surrounding base of median lobe, with small pointed folds; tegmen with apical piece twice as long as basal piece, with concave apex with four blunt spines on each side, of which second from margin is stoutest and third from margin longest. Retracted segment: tergum little sclerotized with blunt hairy apex and transverse row of fenestrae, interrupted in mid-



Figs 405–409: *A.* (*A.*) *lutopictus* van Hille. 405: aedeagus. 406: apex of antenna. 407: apex of elytron of male. 408: elytron of male. 409: spiculum gastrale of male.

dle; sternum consists of pair of narrow lightly sclerotized plates. Spiculum gastrale (Fig. 409) elongate with short basal hook. Last exposed sternum with apical indentation like that of *A.* (*A.*) *poweri* (Fig. 418).

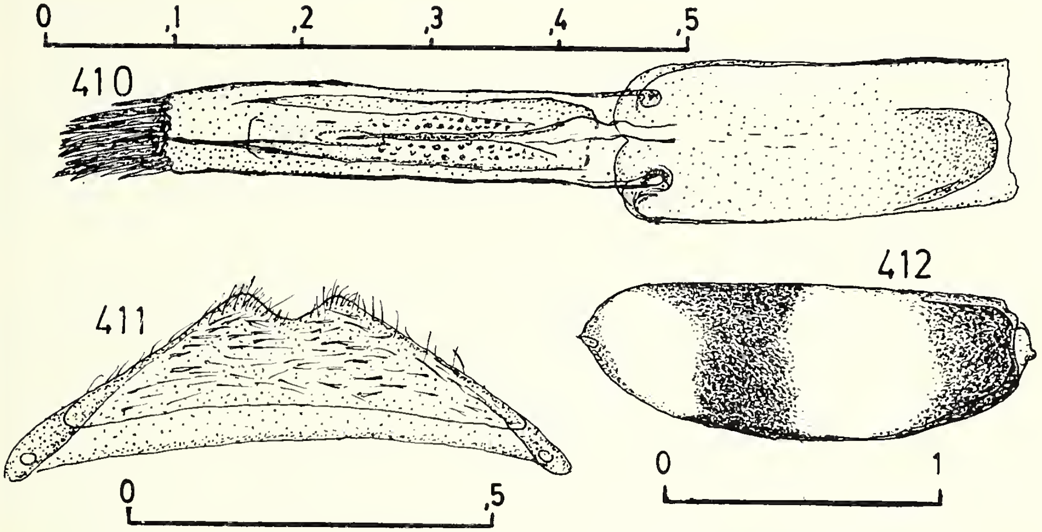
MATERIAL EXAMINED. South Africa: between Grabouw and Houwhoek [3419AA], 29.xii.1950, Holotype ♂, (Brinck & Rudebeck) (UELM); Cedarberg, Kromriver Farm [3219AC], 5.i.1975, 2 ♂♂, (M. W. Mansell) (AMSA); Namaqualand, Horingsgat [3018AC], in Malaise trap, 24–25.ii.1975, 3 ♂♂, (Lamoral, Barnley and Bampton) (AMSA).

*Anthicus (Aulacoderus) manselli* **spec. nov.**, Figs 410–412

Size. Length 2,53 mm (2,00–2,85); width over broadest part of elytra 0,91 mm (0,88–1,05).

*Head.* Glossy, testaceous to black, mouthpart region testaceous; posterior arch broadly round; punctures fine with short procumbent hairs. Eyes large, somewhat bulging.

*Prothorax.* Glossy, testaceous to dark testaceous; broader than long, as broad as head; punctures fine with recumbent hairs, longer than on head; with prominent lateral constrictions at $\frac{3}{4}$ of the length of the prothorax.



Figs 410–412. *A.* (*A.*) *manselli* spec. nov. 410: aedeagus. 411: last exposed abdominal sternum of male. 412: elytron of male.

*Elytra* (Fig. 412). Light testaceous with two transverse black bands, the anterior covering the shoulder area, the posterior one just behind middle, extending backwards along median suture; in some specimens, especially in males, apex also dark; punctures fine with fine grey recumbent hairs, slightly longer than on prothorax.

*Wings*. Fully developed.

*Antennae*. Testaceous, not darker or broader at apex; last segment longer than two preceding ones together.

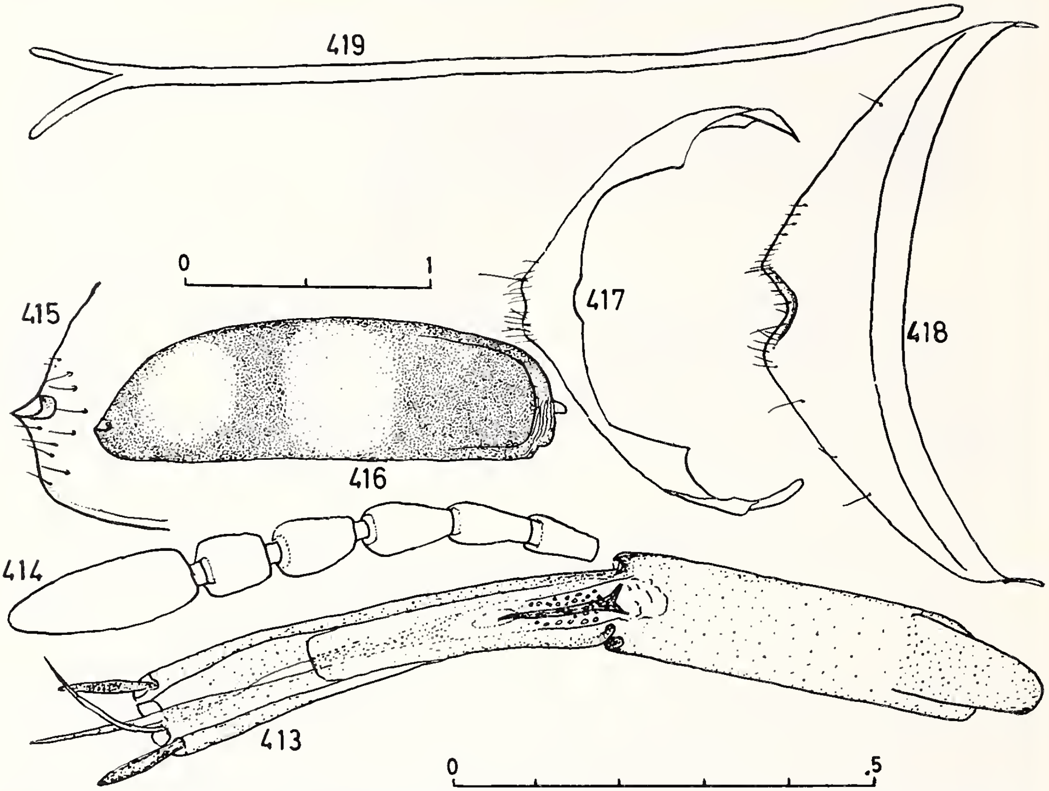
*Legs*. Testaceous.

*Undersurface*. Testaceous, darker towards apex.

*Male abdomen*. Aedeagus (Fig. 410): median lobe membranous with narrow oval genital opening, with finely beaded margin; with narrow sclerotized bar, proximally to genital opening; connecting membrane with small pustules or denticles, surrounding base of median lobe; tegmen: apical piece longer than basal piece and with apical fringe of about 16 spiny hairs. Last exposed sternum (Fig. 411) with apical indentation and dark spiny hairs pointing transversely to median line on surface, but pointing distally on apical margin.

*Female abdomen*. Last exposed tergum with apical indentation. Last exposed sternum with blunt apical point; hairs pointing to apex.

MATERIAL EXAMINED. South Africa: Bains Kloof [3319CA], at light, 10.i.1978, Holotype ♂, Paratypes 16 ♂♂, 9 ♀♀, (M. W. Mansell) (AMSA); Cedarberg [3219AA], at light, 5.i.1975, Paratype 1 ♂, (M. W. Mansell) (AMSA); Clanwilliam, Algeria Forest [3219BB], at light, 8.i.1978, Paratypes 28 ♂♂, 40 ♀♀, (M. W. Mansell) (AMSA); Villiersdorp, Aasvoëlkop [3319CD], 19.xii.1978, Paratype 1 ♂, (G. H. Walter & S. Neser) (AMSA); Ceres [3319AD], xi–xii.1920, Paratypes 1 ♂, 3 ♀♀, (R. E. Turner) (BMNH); Assegaaibosch [3324CD], to light, 4–5.i.1972, Paratypes 2 ♂♂, (Southern African Expedition, British Museum) (BMNH).



Figs 413–419. *A.* (*A.*) *poweri* van Hille. 413: aedeagus. 414: apex of antenna. 415: apex of elytron of male. 416: elytron of male. 417: tergum of retracted abdominal segment of male. 418: last exposed abdominal sternum of male. 419: spiculum gastrale of male.

*Anthicus (Aulacoderus) poweri* van Hille, Figs 413–419

*Anthicus (Aulacoderus) poweri* van Hille, 1961: 236

Size. Length 2,87 mm (2,30–3,17); width over broadest part of elytra 0,93 mm (0,80–1,10).

*Head.* Slightly glossy, dark testaceous to almost black; posterior arch broadly round; punctures very fine with light procumbent hairs. Eyes large, somewhat bulging.

*Prothorax.* Slightly glossy, testaceous to dark testaceous; longer than broad, slightly narrower than head; shoulders round; punctures very fine with light recumbent hairs; lateral constrictions at $\frac{3}{4}$ of the length of the prothorax, well covered by long hairs and dorsally connected by a shallow transverse depression.

*Elytra* (Fig. 416). Elongate, glossy, dark testaceous to black with two pairs of light maculae, anterior pair in front of middle, posterior pair subapical; punctures larger than on prothorax, with short recumbent hairs.

*Wings.* Fully developed.

*Antennae.* Testaceous; apical segments (Fig. 414) not darker and hardly broader; last segment longer than two preceding ones together.

*Legs*. Testaceous to dark testaceous; tarsi lighter.

*Undersurface*. Dark testaceous.

*Male abdomen*. Aedeagus (Fig. 413): median lobe membranous apart from sclerotized arrow-shaped longitudinal bar of which apex lies at level of oval genital opening, which has a finely beaded margin; connecting membrane with some small pustules round base of arrow-shaped bar; tegmen: apical piece with a single pair of apical spines and with membranous infolding margins with interlocking apical points; basal piece shorter than apical piece. Retracted segment: tergum (Fig. 417); sternum consists of a pair of narrow plates. Last exposed sternum (Fig. 418) with round apical indentation.

MATERIAL EXAMINED. South Africa: Vaal River nr Barkley West [2824DA], Holotype ♂, Paratypes 6 ♂♂, (R. J. B. Power) (AMSA); Matjesfontein [3320BA], ix.1928, 4 ♂♂, (R. E. Turner (BMNH); Ladismith [3321AD], at light, 4.i.1951, Paratype ♂, (Brinck & Rudebeck) (AMSA); Vaal River near Kimberley, Nooit Gedacht, [2824DB], xi.1955, Paratypes 10 ♂♂, (J. H. Power) (AMSA); Swellendam, Komnader [3420AB], to meloid bait, 1 ♂, (J. C. van Hille) (AMSA).

*Anthicus (Aulacoderus) lovemorei* **spec. nov.**, Figs 420–421

Size. Length 2,22 mm (2,00–2,55); width over broadest part of elytra 0,77 mm (0,72–0,80).

*Head*. Glossy, testaceous; posterior arch broadly round; punctures minute with fine recumbent hairs. Eyes large and bulging.

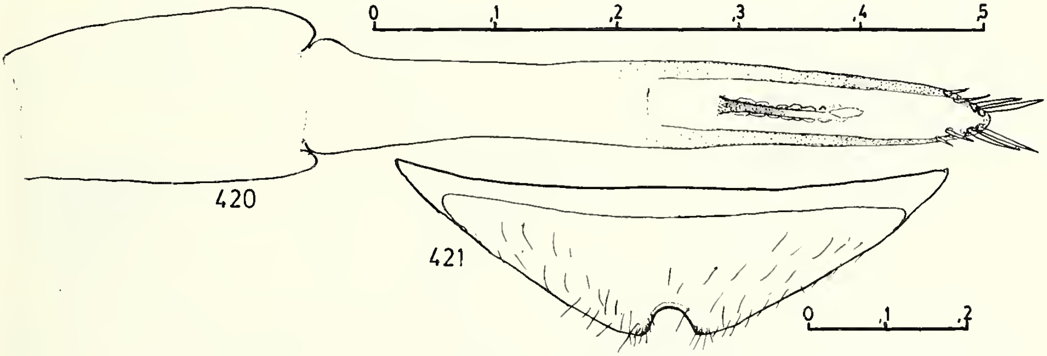
*Prothorax*. Glossy, light testaceous; as long as broad, narrower than head; shoulders round; punctures fine with recumbent hairs; lateral constrictions large and hairy at ⅔ of the length of the prothorax; dorsally hardly depressed at base, without long hairs.

*Elytra*. Glossy, elongate, light testaceous with variable dark markings: there may occur a dark transverse band behind middle which extends along median suture backward almost to apex; in other specimens this band is reduced to a triangular area on the median suture so that the two elytra make a dark diamond-shaped area behind the middle; or the dark markings are completely absent.

*Wings*. Fully developed.

*Antennae*. Testaceous, rather short; apical 3–4 segments slightly broader but not darker; last segment almost as long as three preceding segments together in male; in female not quite as long.

*Legs*. Testaceous.



Figs 420–421. *A.* (*A.*) *lovemorei* spec. nov. 420: aedeagus. 421: last exposed abdominal sternum of male.

*Undersurface*. Light testaceous to testaceous, abdomen slightly darker than thorax.

*Male abdomen*. Aedeagus (Fig. 420): median lobe short with slender sclerotized bar covered by minute dark spots, but fading away toward apex, where it approaches the small oval genital opening; connecting membrane without distinct sclerotizations; tegmen: apical piece with two long and two shorter apical spines on each side; basal piece about half as long as apical piece. Retracted segment: tergum bluntly pointed at apex, with a number of hairs and transverse row of fenestrae, interrupted in middle; sternum consists of pair of narrow membranous plates each with a single sclerotized rib. Last exposed sternum (Fig. 421) with apical indentation.

MATERIAL EXAMINED. Rhodesia (now Zimbabwe): Lubu River, Sebungwe District, on flowers of *Elephantorrhiza goetzei* (Harms) Harms, 3–10.ix.1951, Holotype ♂, Paratypes 4 ♂♂, 3 ♀♀, (D. F. Lovemore) (AMSA).

The last part of the alimentary canal is full of pollen.

*Anthicus (Aulacoderus) coarcticollis* Baudi, Figs 421–424
  *Anthicus (Aulacoderus) coarcticollis* Baudi, 1881: 295

Size. Length 2,50 mm; width over broadest part of elytra 0,75 mm.

*Head*. Glossy, light testaceous; posterior arch broadly round; punctures fine with short coarse procumbent hairs. Eyes large and bulging.

*Prothorax*. Glossy, light testaceous; as long as broad, narrower than head; collar with fringe of erect hairs; punctures fine with recumbent hairs; shoulders round; lateral constrictions at $\frac{2}{3}$ of length of prothorax, deep and hairy and connected by a deep transverse hairy groove.

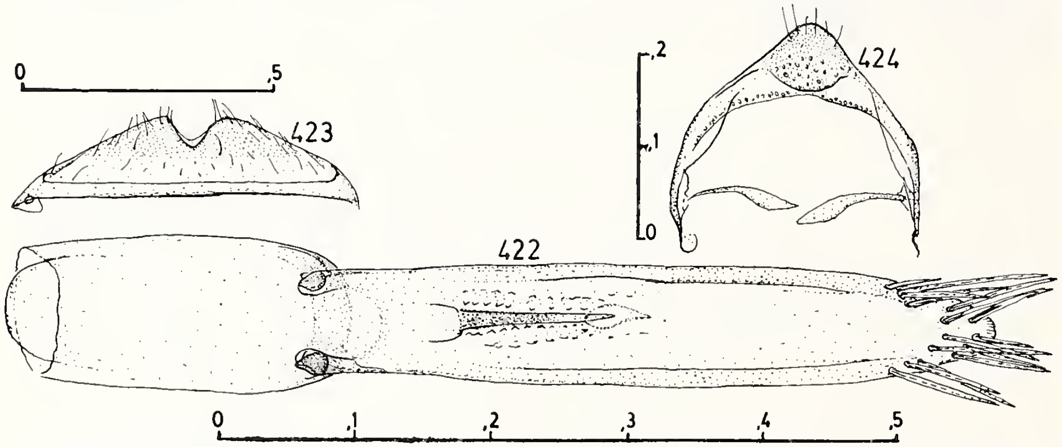
*Elytra*. Glossy, light testaceous; elongate, apically obliquely truncate; punctures distinct with recumbent hairs, longer than on prothorax; in male with small apical point and prominent notch.

*Wings*. Fully developed.

*Antennae*. Light testaceous; apical five segments slightly broader; last segment slightly longer than two preceding ones together.

*Legs and undersurface*. Light testaceous.

*Male abdomen*. Aedeagus (Fig. 422): median lobe membranous except the pointed longi-



Figs 422–424. *A.* (*A.*) *coarcticollis* Baudi. 422: aedeagus. 423: last exposed abdominal sternum of male. 424: retracted abdominal segment of male.

tudinal bar of which the proximal half is covered with minute black spots; it lies proximal to the diamond-shaped genital opening which has a beaded margin; connecting membrane, with small longitudinal teeth, surrounds base of median lobe but its distal part is not visible; tegmen: apical piece with blunt apical point with 8–10 spines on each side, twice as long as the basal piece. Retracted segment (Fig. 424): tergum with hairy bluntly pointed apex and proximal transverse row of fenestrae and several more fenestrae not arranged in a definite pattern; sternum consists of a pair of narrow plates. Last exposed sternum (Fig. 423) with a somewhat rounded triangular apical indentation.

Material examined. Lebanon: no date, Type ♂ (no collector) (MNHN)

In the description of specimens from Syria, Baudi mentions a dark macula on the elytra and three dark abdominal sternites. These dark markings do not occur on the specimen from Lebanon, the only specimen the author has seen.

*Anthicus (Aulacoderus) flavopictus* Laf., Figs 425–427
*Anthicus (Aulacoderus) flavopictus* La Ferté, 1848: 268

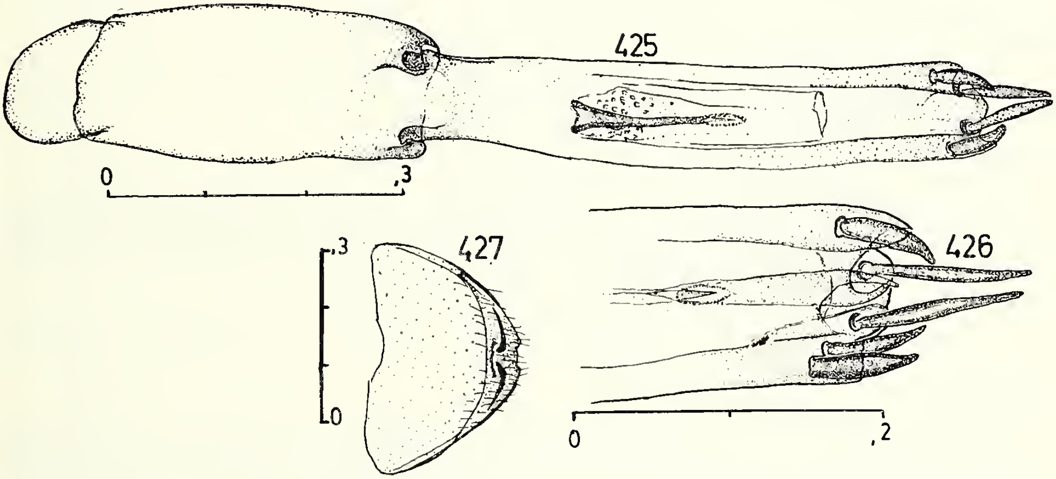
Size. Length 3,00 mm (2,77–3,27); width over broadest part of elytra 0,92 mm (0,87–1,05).

*Head.* Slightly glossy, very dark testaceous to black; posterior arch round, narrowing by an almost straight line to eyes and mouthparts; punctures fine with dark procumbent hairs. Eyes hardly bulging.

*Prothorax.* Slightly glossy, dark testaceous; slightly broader than long, broader than head; shoulders round; with fine recumbent hairs; lateral constrictions at $\frac{3}{4}$ of the length of the prothorax, with long light hairs.

*Elytra.* Elongate, dark testaceous to black with a pair of light maculae in front of middle, usually reaching lateral margin but not median suture, and a pair of less distinct subapical maculae; shoulders round; distinctly punctured, hairs recumbent, of the same colour as the area on which they are implanted. Males with small apical point and prominent square notch.

*Wings.* Fully developed.



Figs 425–427. *A.* (*A.*) *flavopictus* Laf. 425: aedeagus. 426: apex of aedeagus with extra spine. 427: last exposed abdominal tergum of female.

*Antennae*. Slender, testaceous; three apical segments hardly darker and only slightly broader; last segment longer than two preceding ones together.

*Legs*. Testaceous; femora darker and tarsi lighter.

*Undersurface*. Testaceous, abdomen darker than thorax.

*Male abdomen*. Aedeagus (Fig. 425): median lobe short and membranous apart from narrow pointed sclerotized bar; connecting membrane surrounding base of median lobe where it has fine pustules; distal part not visible; tegmen with apical piece almost one and a half times as long as basal piece; apical piece convex at apex with two blunt spines on each side of which the lateral one is shorter and broader than the median one. Retracted segment: tergum with truncate apex, without row of fenestrae; sternum consists of a pair of narrow thin plates. Last exposed sternum with apical indentation resembling that of *A*. (*A*.) *poweri* (Fig. 417).

*Female abdomen*. Last exposed tergum (Fig. 427).

MATERIAL EXAMINED. South Africa: Dunbrody [3325BC], 10.xi.1902, 1 ♂, (Fr O'Neil) (AMSA); same locality, to light, 10–12.xii.1903, 4 ♂♂, 1 ♀, (Fr O'Neil) (AMSA); same locality, 10.xii.1905, 1 ♂ (Fr O'Neil) (AMSA); Willowmore [3323AD], ix.1913, 1 ♀, (Dr Brauns) (AMSA); Somerset East [3225DA], xii.1930, 2 ♂♂, (R. E. Turner) (BMNH); Jansenville, Fairview, [3224DC], to meloid bait, 3 ♂♂, (J. C. van Hille) (AMSA); Grahamstown, Hilton [3326BC], in Malaise trap, 1–16.i.1971, 35 ♂♂, (F. W. Gess) (AMSA).

*Anthicus (Aulacoderus) vaulogeri* Pic, Figs 428–429

*Anthicus (Aulacoderus) vaulogeri* Pic, 1897c: 297

Size. Length 2,12 mm (2,10–2,15); width over broadest part of elytra 0,83 mm (0,81–0,86).

*Head*. Glossy, testaceous; posterior arch broadly round; punctures fine with fine grey procumbent hairs. Eyes somewhat bulging.

*Prothorax*. Glossy, testaceous, slightly lighter than head; as long as broad, narrower than head; round in front; lateral constrictions at $\frac{3}{4}$ of the length of the prothorax, hairy and connected by a sharp transverse dorsal depression; punctures fine with short recumbent hairs.

*Elytra*. Glossy, light testaceous; rather coarsely punctured with fine recumbent hairs and short erect hairs.

*Wings*. Fully developed.

*Antennae*. Testaceous; apical segments not darker but slightly broader; apical segment pointed and longer than two preceding ones together.

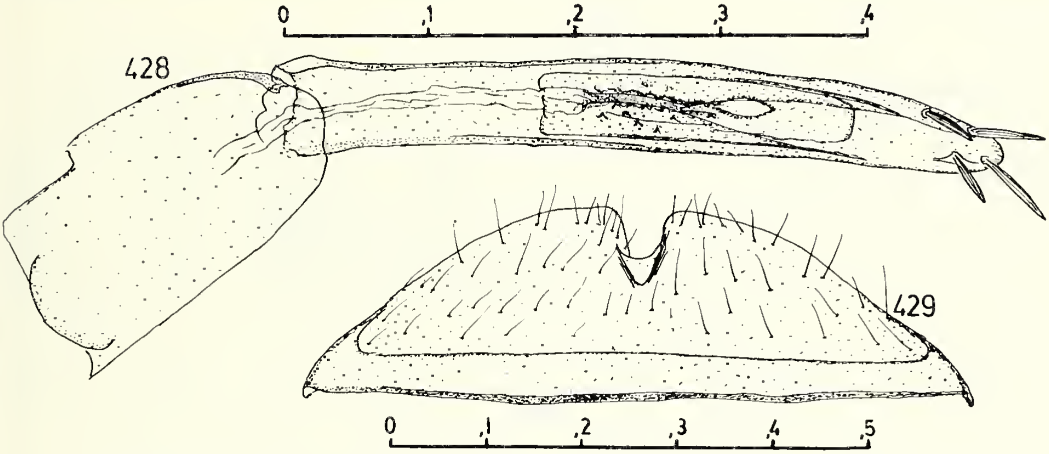
*Legs*. Testaceous, slightly lighter than antennae.

*Undersurface*. Testaceous.

*Male abdomen*. Aedeagus (Fig. 428): median lobe short and membranous apart from longitudinal sclerotized bar which fades out in the region of the spindle-shaped genital opening; connecting membrane surrounding the base of median lobe, with fine triangular folds; tegmen: apical piece with blunt apex with two pairs of spines; basal piece less than half the length of apical piece. Last exposed sternum (Fig. 429) with apical indentation.

MATERIAL EXAMINED. Algeria: Region of Ouarsenis, to light, no date, Type ♂, (Capt. de Vauloger) (MNHN). Morocco: Gd. Atlas, Glaoui VII, on *Clematis flammula*, no date, 1 ♂, (no collector) (NMW).

The latter specimen has been dissected by von Krekich; the aedeagus and the last exposed abdominal sternite of the ♂ are mounted on slide 688B. This slide is labelled '*A. mecheriensis* Chob. det. v. Krekich'. This last species was described by Chobaut (1896) from Algeria, Mecheria, S. Oran. It was found that the specimen and its genitalia are identical with the type of *A*. (*A*.) *vaulogeri* Pic. The descriptions of the two species are very similar but Pic (1897c) men-



Figs 428–429. *A.* (*A.*) *vaulogeri* Pic. 428: aedeagus. 429: last exposed abdominal sternum of male.

tions that *A. vaulogeri* has a broader and more square prothorax than *A. mecheriensis*. It is possible that the names are synonyms in which case the more recent name *vaulogeri* should fall away. However, the younger name has been retained because the Paris specimen is a type from the type locality, while the specimen named by von Krekich is not a type of *A. mecheriensis*, nor does it come from the type locality. The author has not seen an authentic specimen of *A. mecheriensis*.

## SECTION 17

In the three species in this section the central part of the aedeagus is a short (0,2–0,25 mm) sclerotized bar with a narrow elongate genital opening at the pointed apex. This bar is taken to be the median lobe. Its base is surrounded by a membrane with small pustules or denticles in two of the three species. This membrane is a modified connecting membrane; it does not surround the median lobe but lies as a strand on the ventral side of the median lobe.

In the case of *A.* (*A.*) *peyroni* it is shown (Fig. 436) that the median lobe and the connecting membrane can move to the apex of the tegmen. The connecting membrane folds double along the ventral side of the aedeagus and the median lobe becomes exposed with its apex and genital opening beyond the apex of the tegmen. The mechanism of the extrusion is not known.

The species of this section come from Kenya, Ethiopia and Syria respectively.

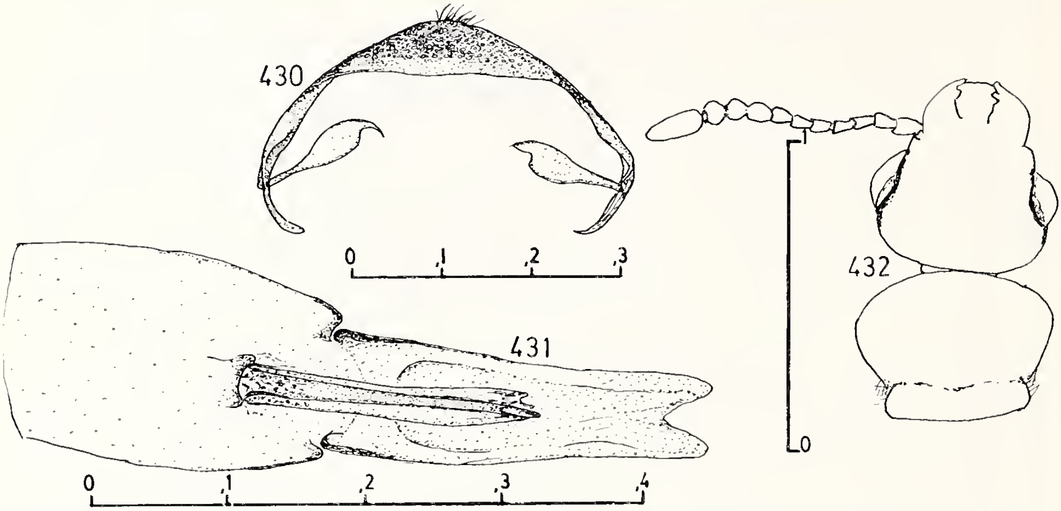
### Key to the species of Section 17

1 Connecting membrane as long as median lobe, with small apical papillae (Fig. 431) .................................................................. *kaffensis*

— Connecting membrane longer than median lobe ................................ 2

2 Connecting membrane almost twice as long as median lobe, with apical sclerotized spines; tegmen without hairs (Fig. 434) .................................. *chappuisi*

— Connecting membrane more than twice as long as median lobe, ending in a pair of pointed lobes; tegmen with two pairs of subapical spiny hairs (Fig. 435) ........ *peyroni*



Figs 430–432. *A.* (*A.*) *kaffensis* spec. nov. 430: retracted abdominal segment of male. 431: aedeagus. 432: head and prothorax.

*Anthicus (Aulacoderus) kaffensis* **spec. nov.**, Figs 430–432

Size. Length 2,07 mm (1,92–2,20); width over broadest part of elytra 0,75 mm (0,65–0,83).

*Head* (Fig. 432). Glossy, black; posterior arch broad; closely punctured, with short procumbent hairs. Eyes somewhat bulging.

*Prothorax* (Fig. 432). Somewhat glossy, black; broader than long, broader than head; finely and densely punctured, with short recumbent hairs; lateral constrictions at $\frac{3}{4}$ of length of prothorax, connected by a sharply indented groove over dorsal surface.

*Elytra*. Glossy, black; oval and rather broad; finely and densely punctured with short grey recumbent hairs.

*Wings*. Fully developed.

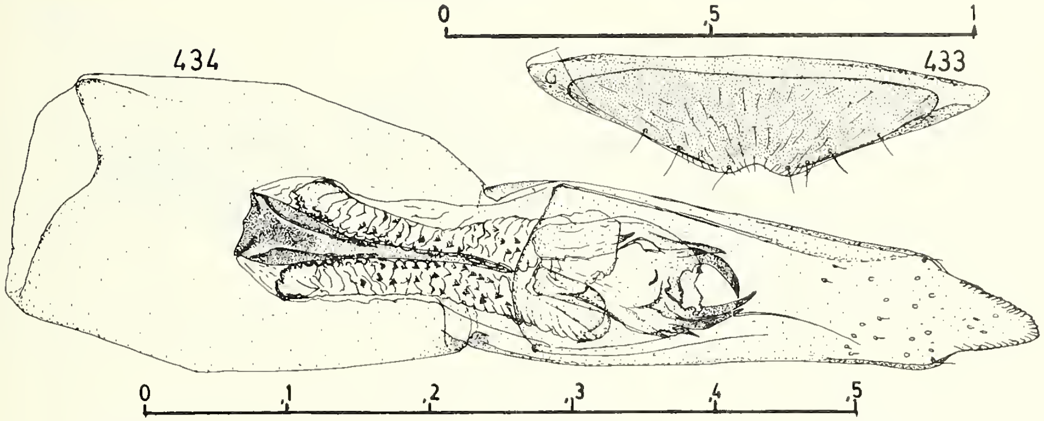
*Antennae* (Fig. 432). Dark testaceous; last four segments slightly broader; apical segment slightly darker and longer than two preceding ones together.

*Legs*. Dark testaceous; distal half of femora slightly darker.

*Undersurface*. Dark testaceous to black.

*Male abdomen*. Aedeagus (Fig. 431): median lobe is a slender sclerotized bar with pointed apex and elongate apical genital opening without beaded margin; its base is broad; connecting membrane attached to the broad base of the median lobe, with small dark pustules at base and small spines at apex; tegmen indented at apex, apical piece longer than basal piece. Retracted segment (Fig. 430): tergum broadly horseshoe-shaped, with some apical hairs; sternum consisting of a pair of short sclerites, apically pointed. Last exposed sternum apically very slightly indented.

MATERIAL EXAMINED. Ethiopia: Kaffa Province, Mui Game Reserve, 700 m, 10–11.iv.1972, Holotype ♂, Paratypes 28 specimens, (R. O. S. Clarke) (MRAC); Sidamo Province, 105 km east of Neghelli, 1 300–1 500 m, 7–8.v.1975, Paratypes 2 specimens, (R. O. S. Clarke) (MRAC); Sidamo Province, Duo Parma River 1 050 m, 12–13.v.1975, 1 specimen, (R. O. S. Clarke) (MRAC).



Figs 433–434. *A.* (*A.*) *chappuisi* Pic. 433: last exposed abdominal sternum of male. 434: aedeagus.

*Anthicus (Aulacoderus) chappuisi* Pic, Figs 433–434
*Anthicus (Aulacoderus) chappuisi* Pic, 1939: 163

Size. Length 2,85 mm width over broadest part of elytra 0,87 mm.

*Head*. Glossy, dark testaceous; posterior arch broadly round; with fine punctures and fine procumbent hairs. Eyes not much bulging.

*Prothorax*. Glossy, slightly lighter than head; longer than broad, as broad as head; shoulders sloping and somewhat angular; punctures fine with fine recumbent hairs; lateral constrictions prominent, at $\frac{2}{3}$ of length of prothorax, with long hairs and connected by a dorsal transverse groove which is hairy except in the median area.

*Elytra*. Glossy, testaceous but darker on shoulders and with a dark transverse band behind the middle; apical quarter lighter; elongate and rather narrow; with fine punctures and fine recumbent hairs; some erect hairs on apical area.

*Wings*. Fully developed.

*Antennae*. Testaceous, apical segments not darker but somewhat broader; last segment as long as two preceding ones together.

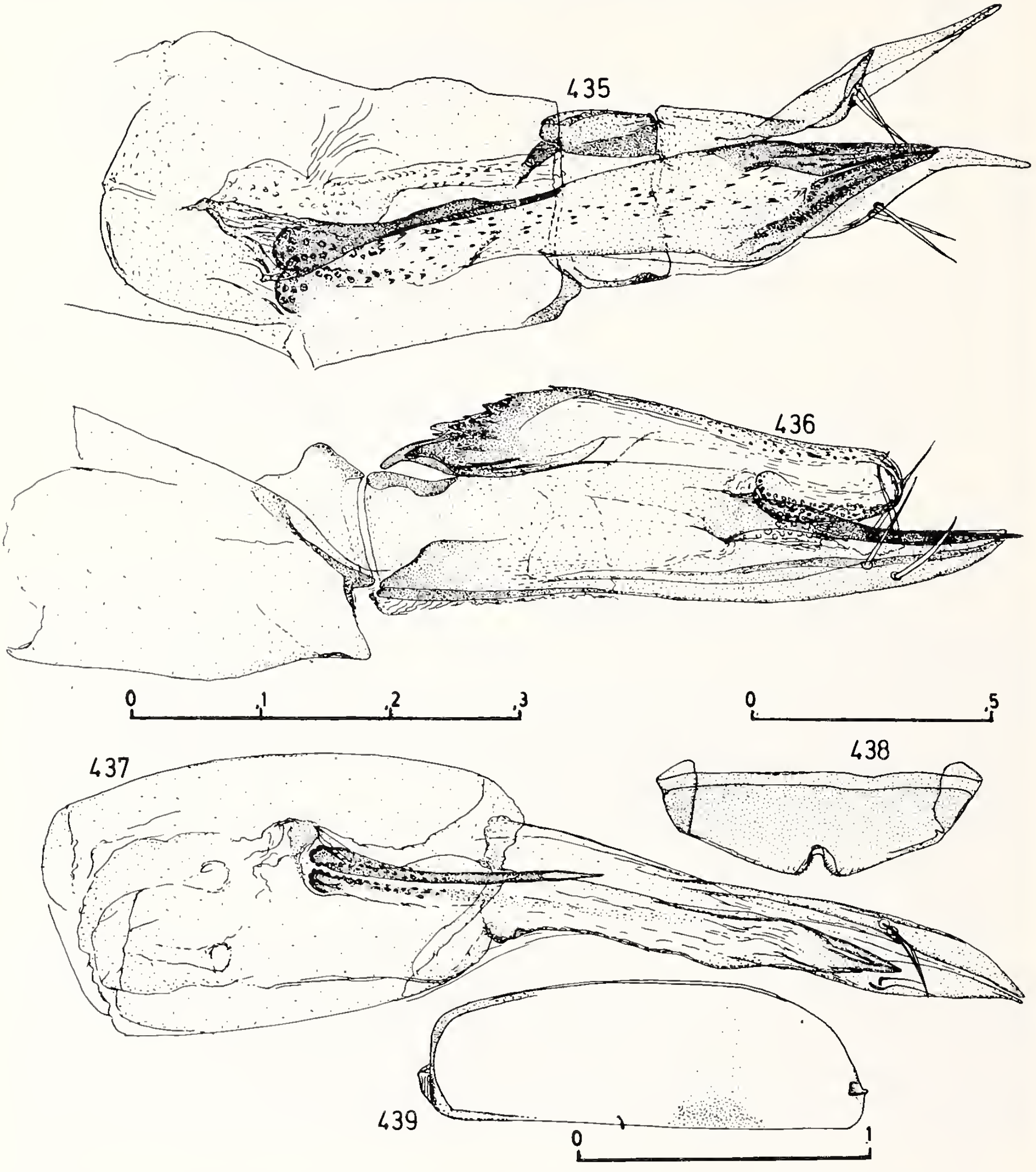
*Legs*. Testaceous, tarsi light testaceous.

*Undersurface*. Reddish testaceous.

*Male abdomen*. Aedeagus (Fig. 434): median lobe well sclerotized with sharply pointed apex with elongate apical genital opening; connecting membrane attached to base of median lobe in the form of wrinkled membranes with small distally pointing denticles; distal to the apex of the median lobe the membrane has large distally pointing spines, three on one side, four on the other side; tegmen with bluntly pointed apical piece, longer than basal piece. Retracted segment: tergum apically pointed, with indistinct transverse row of fenestrae; sternum consists of a pair of slender sclerotized bars. Last exposed sternum (Fig. 433) with shallow apical identation.

Material examined. Kenya: Lokitang, Turkana Nord, 750 m, no date, Type ♂, (Mission de l'Omo 1932–1933, C. Arambourg, P. A. Chappuis & R. Jeannel.)

This specimen is labelled '*Anthicus (Aulacoderus) alitienensis* var. *chappuisi*' in Pic's handwriting but it is described as *Anthicus (Aulacoderus) chappuisi*: '. . . très voisin de *A. alitienensis* Pic, s'en distingue par la tête plus foncée, le prothorax un peu moins robuste, le sillon plus éloigné de la base, les élytres à dessins noirs autrement disposés'.



Figs 435–439. *A.* (*A.*) *peyroni* Pic. 435: aedeagus, inverted, specimen from Ethiopia. 436: aedeagus, everted, side view, specimen from Ethiopia. 437: aedeagus, inverted, ventral view, type from Syria. 438: last exposed abdominal sternum of male. 439: elytron of male.

*Anthicus (Aulacoderus) peyroni* Pic. Figs 435–439
*Anthicus (Aulacoderus) peyroni* Pic, 1900b: 78

Size. Length 2,45 mm (2,32–2,65); width over broadest part of elytra 0,87 mm (0,85–0,90).

*Head.* Glossy, testaceous; posterior arch round; punctures fine with fine procumbent hairs. Eyes darkly margined, rather large and somewhat bulging.

*Prothorax.* Glossy, slightly lighter than head; longer than broad, narrower than head; shoulders round; punctures fine with fine recumbent hairs; lateral constrictions at $\frac{3}{4}$ of the length of the prothorax, with fine long hairs.

*Elytra* (Fig. 439). Glossy, light testaceous; in male with incomplete dark transverse band behind the middle; in female dark on shoulder and a complete dark transverse band behind middle; these are probably not sexual differences but progression and regression of pigmentation within the species; with fine punctures with fine short recumbent hairs.

*Wings.* Fully developed.

*Antennae.* Testaceous; apical four segments slightly broader; apical segment of male as long as three preceding ones together, in female as long as two preceding ones together.

*Legs.* Light testaceous.

*Undersurface.* Testaceous, abdomen darker than thorax.

*Male abdomen.* Aedeagus (Figs 435, 436 and 437): median lobe short slender well sclerotized bar-shaped with pointed apex with elongate genital opening; connecting membrane surrounding base of median lobe as a pair of strands with dark pustules on the proximal area; it proceeds distally as a strand more than twice the length of the median lobe and ends in a pair of subapical pointed lobes; tegmen membranous: apical piece ending in a pair of pointed lobes, each with two long hairs; basal piece hardly shorter than apical piece. Retracted segment: tergum little sclerotized with an indication of a transverse row of fenestrae; sternum consists of a pair of thin narrow plates, apically pointed and with another point on the proximal margin, more than half-way from the attachment to the tergite. Last exposed sternum (Fig. 438) with apical indentation.

MATERIAL EXAMINED. Syria: no date, Types 1 ♂, 1 ♀, Krekich *vidit*, (Reitmerz (?)) (MNNH). Ethiopia: Meneghetti, Dire Dawa, 16.vii.1942, 1 ♂, (no collector) (MNNH): Mulu above Muger Valley circa 8 000 ft, 18–23.xii.1926, 1 ♂, (Dr H. Scott) (MNNH).

The ♂ type from Syria was damaged and incomplete ventrally but the aedeagus is complete; all parts are now mounted in canada balsam on a microscope-slide.

The last specimen is labelled '*Aulacoderus alitienensis* var. nov. *breveapicalis*' in Pic's handwriting. The species is described from Ethiopia (Pic 1897a) and the variety from Ethiopia, Mulu above Muger Valley (Pic 1951). The variety differs from the species by darker markings on the elytra. The author has only seen a ♀ of *A.* (*A.*) *alitienensis* Pic and judging from the external features it is not impossible that it is the same species as *A.* (*A.*) *peyroni* Pic. However without having seen a ♂ of *A.* (*A.*) *alitienensis* opinion must be reserved. The specimen differs from *A.* (*A.*) *peyroni* Pic by its more progressive pigmentation. The aedeagus (Fig. 435), the retracted segment and the spiculum gastrale are more sclerotized than in the type specimen from Syria. The structure of the genitalia is essentially the same.

Fig. 436 shows the aedeagus of the specimen from Ethiopia, Meneghetti in lateral view. The connecting membrane is everted and reflexed along the ventral side of the tegmen. This makes the median lobe project beyond the apex of the tegmen. From the position of the connecting membrane it can be seen that this movement can still proceed which would bring the median lobe another 0,1 mm more distal, so that the genital opening is exposed well beyond the apex of the tegmen. This process is a modification of the eversion as it occurs in the Albitarsis Group, but it achieves the same result.

## SECTION 18

In the two species of this section the median lobe of the aedeagus is membranous but has a sclerotized transverse base. The genital opening is elongate and has a beaded margin. There is no sclerotized longitudinal spike.

The connecting membrane is attached to the sclerotized base and, as in the species of Section 17, folds double along the ventral side of the aedeagus when eversion takes place (Fig. 444).

The two species are very similar; they both occur in the Mediterranean area but *A. (A.) funebris* mainly occurs round the Adriatic Sea and *A. (A.) sulcithorax* occurs more eastward in Israel and Syria.

### Key to the species of Section 18

1 Last exposed abdominal sternum of male with two spines on each side of the round apical indentation (Fig. 443) ........................................ *sulcithorax*
— Last exposed abdominal sternum of male with three spines on each side of the bluntly pointed apex (Fig. 448) ........................................ *funebris*

*Anthicus (Aulacoderus) sulcithorax* Desbr., Figs 440–443
*Anthicus (Aulacoderus) sulcithorax* Desbrochers, 1875: 46

Size. Length 2,18 mm (1,87–2,40); width over broadest part of elytra 0,87 mm (0,72–0,95).

*Head* (Fig. 442). Glossy, dark testaceous to black; posterior arch broadly round; punctures fine and sparse with fine grey procumbent hairs. Eyes rather small and hardly bulging.

*Prothorax* (Fig. 442). Glossy, testaceous to black with a lighter base; broader than long, as broad as head; shoulders sloping and round; punctures fine, somewhat closer than on head with grey recumbent hairs; lateral constrictions at ⅔ of the length of the prothorax, connected by a well marked basal dorsal transverse groove.

*Elytra*. Glossy, dark testaceous to black, in some specimens lighter than prothorax; punctures fine with recumbent hairs slightly longer than on prothorax but still rather short.

*Wings*. Fully developed.

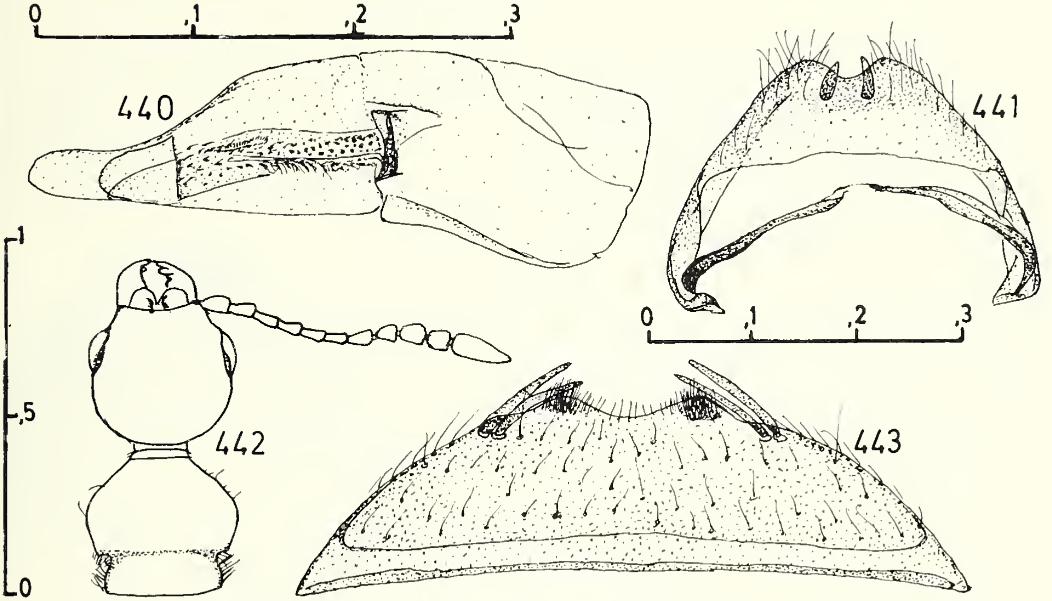
*Antennae* (Fig. 442). Slender, testaceous to very dark testaceous; apical segments little broader and darker in the lighter coloured specimens; apical segment longer than two preceding ones together.

*Legs*. Testaceous to dark testaceous; tibiae and tarsi lighter.

*Undersurface*. Dark testaceous to black.

*Male abdomen*. Aedeagus (Fig. 440): median lobe membranous except for a dark basal plate; with elongate genital opening with beaded margin; connecting membrane with dark pustules at base of membranous part of median lobe and small hooks in the more distal region; tegmen lightly sclerotized, apical piece longer than basal piece. Retracted segment (Fig. 441): tergum indented at apex with short thick spine on each side; sternum consists of pair of narrow sclerites, connected to each other by a few fine strands. Last exposed sternum (Fig. 443) with shallow apical indentation and on each side a tuft of close hairs and two long spines pointing inward.

MATERIAL EXAMINED. Israel: Jericho, vii–viii.1929, 2 ♂♂, R. F. Heberdey det., (I. Tapuschi) (NMW); Jericho, no date, 1 ♀, Krekich det., (no collector) (NMW); Jericho, 27.iv.1933, 1 ♂, 3 ♀♀, (C. Koch) (NMW); Jericho, no date, 2 specimens, Pic, det., (no collector) (NMW); Jerusalem, 10.iv.1931, 1 specimen, (F. S. Bodenheimer) (NMW); Jerusalem, no date, 1 specimen, (Reitter) (NMW); Mikve Israel, 1931, 1 specimen, (F. S. Bodenheimer) (NMW); Jericho, 6.viii.1929, 1 ♀, (I. Tapuschi) (BMNH); Jerusalem, 10.vi.1931, 2 ♂♂ Heberdey det., (F. S. Bodenheimer) (BMNH). Crete: no date, 1 specimen, (Paganetti) (NMW).



Figs 440–443. *A.* (*A.*) *sulcithorax* Desbr. 440: aedeagus. 441: retracted abdominal segment of male. 442: head and prothorax. 443: last exposed abdominal sternum of male.

*Anthicus (Aulacoderus) sulcithorax* **subsp. nov.** *melitensis* (Pic)
*Anthicus (Aulacoderus) melitensis* Pic, 1903c: 139

In size and structure this subspecies agrees with *A. (A.) sulcithorax* Desbr. but the colour is different. Head is black but prothorax is brightly reddish testaceous; basal two segments and apical 3–4 segments of antennae are darker than the testaceous middle segments.

Material examined. Malta: 1903, 1 ♂, 1 ♀, (M. C.) (BMNH).

*Anthicus (Aulacoderus) funebris* (Reitt.), Figs 444–448
*Tomoderus* (?) *funebris* Reitter, 1884: 257
*Anthicus (Aulacoderus) sulcatus* Pic, 1897a: 75

Size. Length 2,11 mm (1,87–2,30); width over broadest part of elytra 0,86 mm (0,80–0,92).

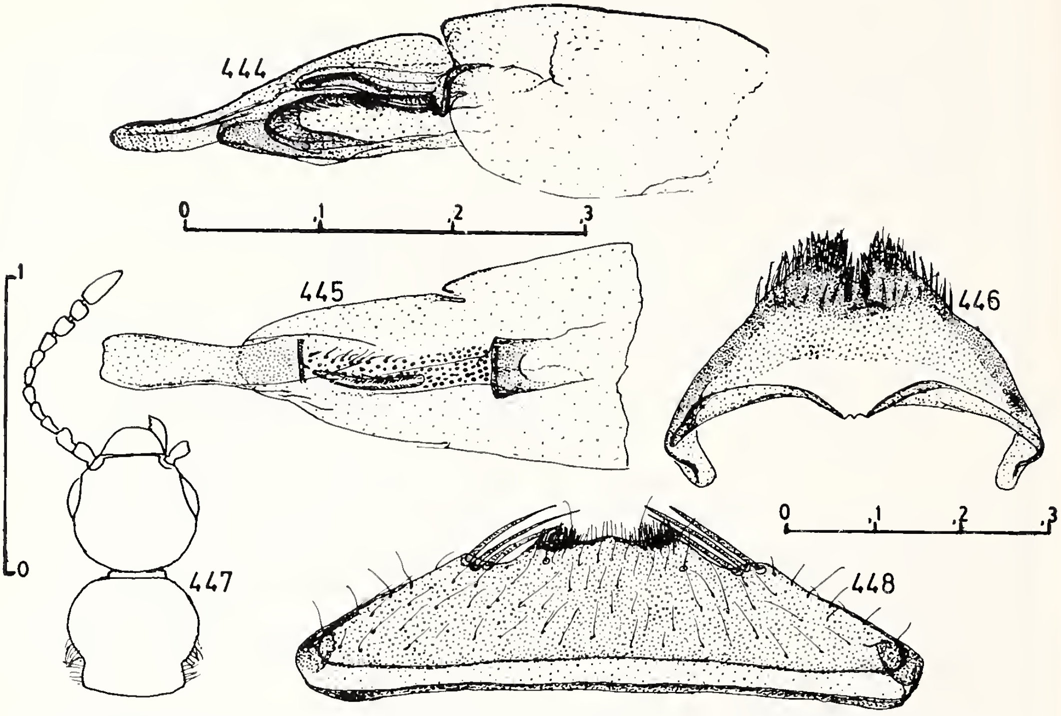
*Head.* (Fig. 447). Glossy, dark testaceous to black; posterior arch broadly round; punctures very fine and sparse with grey procumbent hairs. Eyes rather small and little bulging.

*Prothorax* (Fig. 447). Glossy, dark testaceous to black; broader than long, as broad as head; shoulders round; punctures as on head with recumbent hairs; lateral constrictions at $\frac{2}{3}$ of the length of the prothorax, well supplied with hairs and connected by a dorsal transverse groove.

*Elytra.* Glossy, dark testaceous to black; rather broad and short; punctures more distinct than on prothorax, hairs longer and recumbent; in male with short round apical notch.

*Wings.* Fully developed.

*Antennae* (Fig. 447). Dark testaceous; five apical segments gradually broader; last segment as long as two preceding ones together.



Figs 444–448. *A.* (*A.*) *funebris* (Reitt.). 444: aedeagus, partly everted, side view. 445: aedeagus, inverted, dorsal view. 446: retracted abdominal segment of male. 447: head and prothorax. 448: last exposed abdominal sternum of male.

*Legs.* Testaceous to dark testaceous, distal parts somewhat lighter.

*Undersurface.* Testaceous to dark testaceous, thoracic parts lighter than abdomen.

*Male abdomen.* Aedeagus (Fig. 445): median lobe sclerotized at base, apical part membranous with elongate genital opening with beaded margin; connecting membrane surrounding membranous part of median lobe, with small pustules and distally with a lateral row of hairs or fine spines on each side; tegmen little sclerotized, apical piece slightly longer than basal piece; Fig. 444 shows aedeagus in lateral view partly everted; connecting membrane folds double along ventral side of aedeagus, resembling the method of eversion as seen in the species of Section 17. Retracted segment (Fig. 446): tergum apically indented with several short spines which become thinner and more hairlike toward the sides and a pair of dark short spines at base of median apical indentation; sternum consists of a pair of slender sclerites, apically connected by a fine strand. Last exposed sternum (Fig. 448) with on each side of apex a dense tuft of spiny hairs which in the median area go over into thinner hairs; on each side three inward pointing spines.

Material examined. Yugoslavia: Dalmatia, I. Lissa, (no date) 1 specimen, (no collector) (NMW); Dalmatia, Zara, (no date), 1 specimen, (no collector) (NMW); Dalmatia, Spalato (now Split) (no date), 1 specimen, (Karaman) (NMW). Albania: Elbasan, (no date), 5 specimens, (Mader) (NMW); Vorra, (no date), 1 specimen, (Mader) (NMW); Durazzo, Ravasini, Lona, (no date), 1 specimen, (NMW). Italy: Lesina, 1914, 11 specimens, (Horv.) (NMW); I.

Curzola, vii.1913, 1 specimen, (Mussapp) (NMW); Comisa, vii.1909, 2 specimens, (NMW). A number of these specimens are labelled '*A. funebris* det. v. Krekich'.

In addition a specimen labelled Greece, Corfu, (no date) *A. sulcatus* Pic (1897a) type ♂, (MNHN) has been examined. According to the description this species differs from *A.* (*A.*) *funebris* (Reitt.) in the shape of the prothorax which is somewhat angular and has a deeper transverse basal groove. The author cannot see that the prothorax of this specimen differs from that of *A.* (*A.*) *funebris* and the male genitalia are identical. It is concluded that *A.* (*A.*) *sulcatus* Pic is a synonym of *A.* (*A.*) *funebris* (Reitt.). The name *A.* (*A.*) *sulcatus* should be discarded.

## SECTION 19

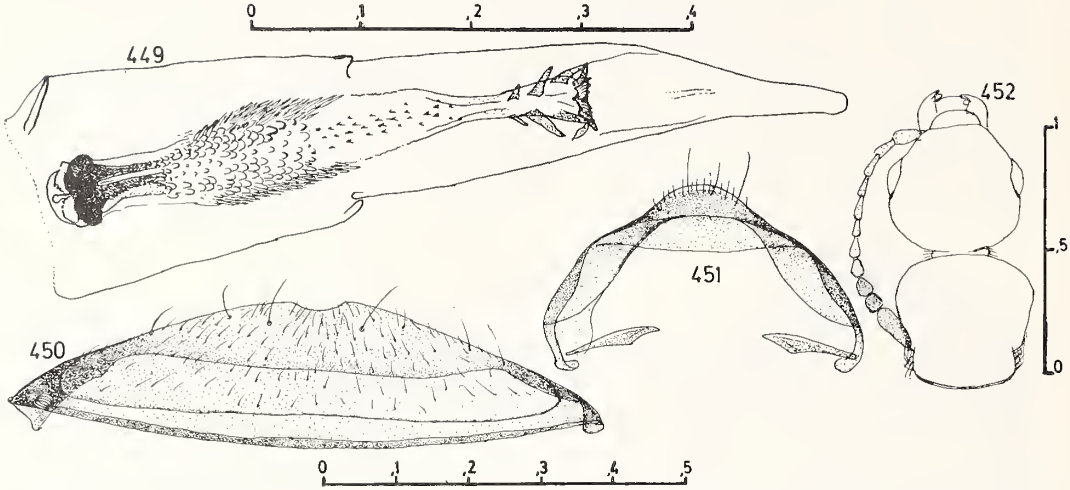
The species of this section do not form a group of related species but are species that do not fit into the other sections. The structure of the aedeagus is aberrant; the position of the genital opening is in most cases not obvious and the median lobe is in some cases reduced. There are spines and sclerotized papillae that are difficult to interpret.

The work was made difficult by the fact that in most cases little material was available, often only one or two specimens, on loan from various museums.

One of the species is from South Africa, one from South West Africa, two from the Canary Islands and the other seven from North Africa.

### Key to the species of Section 19

1. Apical piece of tegmen of aedeagus longer than basal piece ..................... 2
— Apical piece of tegmen of aedeagus as long as or shorter than basal piece .......... 4
2. Apical piece of tegmen of aedeagus without apical or subapical spines (Fig. 449) .... ................ *canariensis*
— Apical piece of tegmen of aedeagus with apical or subapical spines ................ 3
3 Apical piece of tegmen of aedeagus with one pair of subapical spines (Fig. 453) ..... ................ *scydmaenoides*
— Apical piece of tegmen of aedeagus with more than 20 subapical spines (Fig. 455) ... ................ *inoblitus*
4 Apical piece of tegmen of aedeagus with a number of spines or papillate sclerotizations (Figs 459, 464 and 469) ................ 5
— Apical piece of tegmen of aedeagus without spines or sclerotized structures ........ 7
5 Last exposed abdominal sternum of male indented at apex ...................... 6
— Last exposed abdominal sternum of male not indented at apex (Fig. 461) ...... *techowi*
6 Sclerites forming sternum of retracted abdominal segment of male with fringe of stiff recumbent hairs (Fig. 466) ................ *obockianus*
— Sclerites forming sternum of retracted abdominal segment of male with 4–5 apical spines (Fig. 472) ................ *ganglbaueri*
7 Elytra dark testaceous or black with one or two pairs of distinct light maculae ...... 8
— Elytra not dark with distinct light maculae ................ 9
8 Elytra dark testaceous with two pairs of light maculae ................ *lyonychoides*
— Elytra black with one pair of round light maculae behind the middle (Fig. 474) ..... ................ *platypennis*
9 Tegmen of aedeagus ending in two points; median lobe very slender (Fig. 484) *picheyrei*
— Tegmen of aedeagus ending in a single point ................ 10
10 Median lobe of aedeagus with two pairs of broad spines (Fig. 485) ............ *sulcifer*
— Median lobe of aedeagus with 6 spines of different length, one of which is forked at apex (Fig. 490) ................ *sefrensis*



Figs 449–452 *A.* (*A.*) *canariensis* Woll. 449: aedeagus. 450: last exposed abdominal sternum of male. 451: retracted abdominal segment of male. 452: head and prothorax.

*Anthicus (Aulacoderus) canariensis* Woll., Figs 449–452

*Anthicus (Aulacoderus) canariensis* Wollaston, 1864: 523–524

Size. Length 2,50 mm (2,20–2,82); width over broadest part of elytra 0,87 mm (0,75–1,00).

*Head* (Fig. 452). Glossy, dark testaceous to black; posterior arch broadly round; punctures fine with fine hairs directed transversely outwards, except on anterior quarter where they are procumbent. Eyes small, hardly bulging.

*Prothorax* (Fig. 452). Glossy, dark testaceous to black, with lighter posterior margin; as long as broad, as broad as head; shoulders round; lateral constrictions not prominent but with some long hairs, connected by shallow transverse dorsal groove; punctures somewhat coarser than on head, hairs recumbent.

*Elytra*. Somewhat glossy, testaceous with darker line along median suture and a less dark marginal line along posterior three-fifth; elongate with round shoulders; with fine and rather close punctures with regular short recumbent hairs. Male apical notch short and broad.

*Wings*. Fully developed.

*Antennae*. (Fig. 452). Testaceous, apical 3–4 segments slightly darker and broader; apical segment longer than two preceding ones together.

*Legs*. Testaceous, coxae and distal half of femora darker.

*Undersurface*. Dark testaceous.

*Male abdomen*. Aedeagus (Fig. 449): median lobe: genital opening not visible; elongate with several short apical spines and three pairs of longer lateral subapical spines; on the distal half occur a number of small proximally pointing spines or denticles, on the proximal half is an area of round scales which laterally lengthen to distally pointing small spines; this area may be a formation of the connecting membrane which otherwise is not evident; tegmen with bluntly pointed apical piece, one and a half times as long as basal piece. Retracted segment (Fig. 451): tergum rather broad; sternum consists of short narrow sclerites. Last exposed sternum (Fig. 450) with shallow apical indentation.

The hindgut of the dissected specimen was full of pollen.

Material examined. Canary Islands: Fuerteventura, Matural, 24.iii.1963, 1 ♂, 2 ♀♀, P. Bonadona det., (Lindberg) (ZSBM).

*Anthicus (Aulacoderus) scydmaenoides* Woll., Figs 453–454

*Anthicus (Aulacoderus) scydmaenoides*, Wollaston, 1864: 524–525.

Size. Length 1,83 mm (1,75–1,95); width over broadest part of elytra 0,70 mm (0,67–0,75).

*Head*. Somewhat glossy, reddish to dark testaceous; posterior arch broadly round; with rather coarse punctures and fine procumbent whitish hairs. Eyes rather small, hardly bulging.

*Prothorax*. Somewhat glossy, slightly lighter than head; broader than long, almost as broad as head; shoulders round, not sloping; punctures rather coarse, with fine recumbent hairs; lateral constrictions small; dorsal transverse depression hardly noticeable.

*Elytra*. Somewhat glossy, testaceous, same colour as prothorax; short and rather broad, greatest breadth in front of middle; shoulders sloping; punctures rather coarse with short whitish recumbent hairs.

*Wings*. Reduced in both sexes.

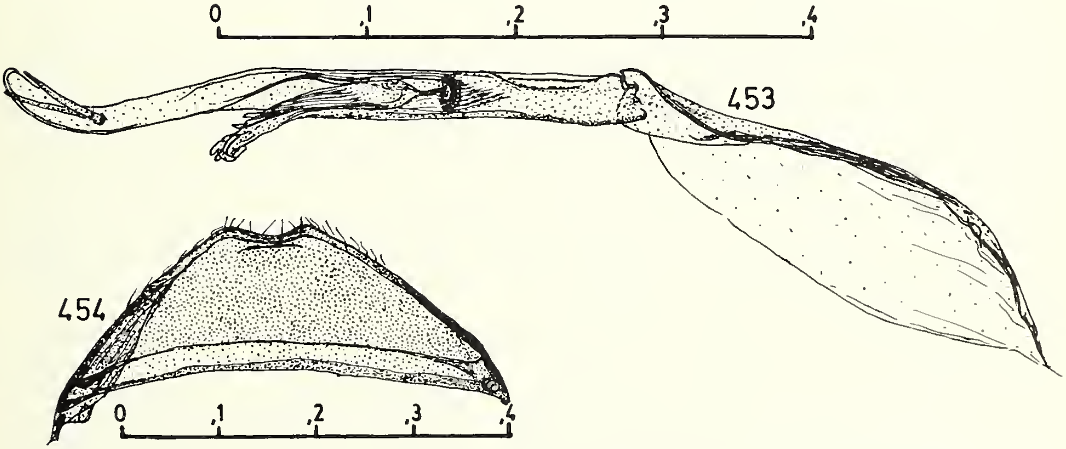
*Antennae*. Testaceous; apical four segments slightly broader but not darker; apical segment shorter than two preceding ones together.

*Legs*. Light testaceous to testaceous.

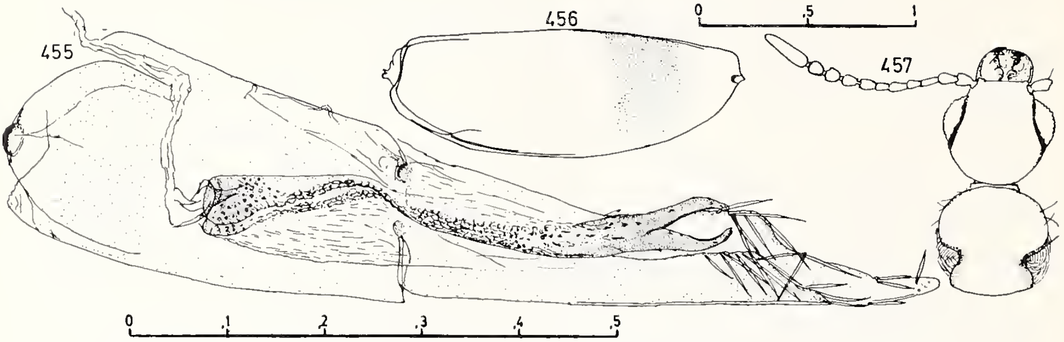
*Undersurface*. Light testaceous to testaceous.

*Male abdomen*. Aedeagus (Fig. 453): median lobe short, with some blunt apical and lateral spines, about eight together; genital opening not visible; connecting membrane not clear; tegmen: apical piece with a pair of subapical spines; basal piece shorter than apical piece. Retracted segment: tergum little sclerotized; sternum consisting of a pair of narrow short sclerites. Last exposed sternum (Fig. 454) with shallow apical indentation.

Material examined. Canary Islands: 99. 203, 2 ♂♂, 2 ♀♀, (no collector) (HBMNH).



Figs 453–454. *A.* (*A.*) *scydmaenoides* Woll. 453: aedeagus. 454: last exposed abdominal sternum of male.



Figs 455–457. *A.* (*A.*) *inoblitus* Krek. 455: aedeagus. 456: elytron of male. 457: head and prothorax.

*Anthicus (Aulacoderus) inoblitus* Krek., Figs 455–457
*Anthicus (Aulacoderus) inoblitus* von Krekich, 1913: 96.

Size. Length 2,45 mm (2,15–2,73); width over broadest part of elytra 0,93 (0,80–1,04).

*Head* (Fig. 457). Glossy, dark testaceous; posterior arch broadly round; punctures hardly visible with dark procumbent hairs. Eyes with dark margin, large and bulging.

*Prothorax* (Fig. 457). Glossy, light testaceous to testaceous; as long as broad, narrower than head; shoulders round; lateral constrictions at $\frac{2}{3}$ of length of prothorax, connected by transverse dorsal depression; punctures very fine with recumbent hairs as long as on head, but hairs are procumbent behind dorsal basal depression.

*Elytra* (Fig. 456). Glossy, light testaceous with dark band behind middle; elongate, with fine punctures and recumbent hairs, longer than on prothorax; some erect and semi-erect hairs, especially near lateral margins.

*Wings*. Fully developed.

*Antennae* (Fig. 457). Light testaceous; apical four segments slightly broader but not darker; last segment as long as three preceding ones together.

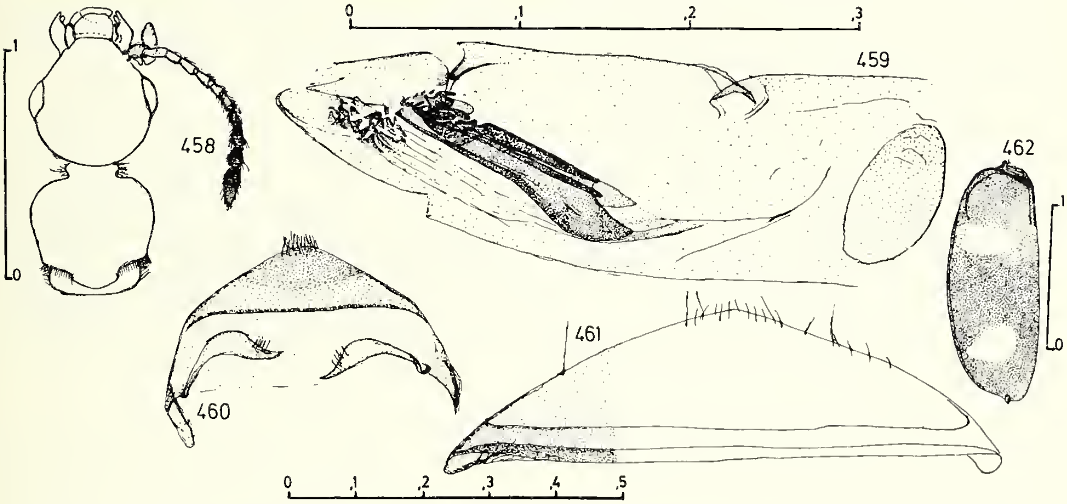
*Legs*. Light testaceous.

*Undersurface*. Light testaceous, abdomen somewhat darker.

*Male abdomen*. Aedeagus (Fig. 455): median lobe pigmented only where it ends in a pair of blunt prongs; genital opening not visible; connecting membrane surrounding base of median lobe, where it is covered by small pustules which distally go over into scales; tegmen with blunt apex with several spines on the lateral margins; apical piece longer than basal piece. Retracted segment: tergum with truncate apex with short hairs; without row of fenestrae but small fenestrae occur spread over the whole surface; sternum consisting of a pair of short narrow triangular plates of which only the proximal margin is well sclerotized. Last exposed sternum with bluntly round apex.

MATERIAL EXAMINED. Niger: Irabellaben Mts, Baguezans, 1 200–1 300 m, 26–31.viii.1947, 1 ♂, Pic. det., (L. Chopard & A. Villiers) (MNHN); Mts Tarraouaji 900 m, 8–12.ix.1947, 4 ♂♂, (L. Chopard & A. Villiers) (MNHN).

Krekich mentions that the ♀ has on the prothorax, on each side a small 'deutlich abstehendes Zäpfchen' as is also found in *A. bouvieri* and in *A. citernii*. Unfortunately the author has not seen a ♀ of *A. inoblitus* and no specimens of *A. bouvieri*. A ♀ of *A. citernii* has a pointed edge in front of the lateral constrictions of the prothorax which the author assumes to be the 'Zäpfchen' of Krekich. This resembles the point found in the male of *A. lyonychoides* (Fig. 481). In *A. sefrensis* of which Krekich has not seen a female, the side of the prothorax is not pointed in either sex.



Figs 458–462. *A.* (*A.*) *techowi* Pic. 458: head and prothorax. 459: aedeagus. 460: retracted abdominal segment of male. 461: last exposed abdominal sternum of male. 462: elytron of male.

*Anthicus (Aulacoderus) techowi* Pic, Figs 458–462
*Anthicus (Aulacoderus) techowi* Pic, 1913a: 38.

Size. Length 2,43 mm (2,39–2,45); width over broadest part of elytra 0,86 mm (0,80–0,95).

*Head* (Fig. 458). Glossy, dark testaceous to black; posterior arch broadly round; with fine punctures and fine short procumbent hairs. Eyes slightly bulging.

*Prothorax* (Fig. 458). Slightly glossy, very dark testaceous; as broad as long, slightly narrower than head; shoulders round; with fine punctures and short recumbent hairs; lateral constrictions at $\frac{3}{4}$ of the length of the prothorax, covered by long white hairs and connected by a basal dorsal transverse groove which is covered by a white hairband, interrupted over the median third.

*Elytra* (Fig. 462). Rather short and broad with well developed shoulders; glossy, very dark testaceous with two pairs of light maculae, the anterior pair not quite reaching the median suture and almost reaching the lateral margins; in some specimens there is an almost complete transverse light band, in others the maculae are placed obliquely, marginal more anterior than median; the posterior pair of maculae smaller and round; finely and densely punctured with short recumbent hairs of the same colour as the area on which they are implanted; the hairs on the median half of the anterior maculae are pointing transversely outwards and those on the lateral half are pointing obliquely outwards and backwards.

*Wings*. Fully developed.

*Antennae* (Fig. 458). Testaceous, apical 4–6 segments dark and slightly broader; last segment as long as two preceding ones together.

*Legs*. Testaceous, femora and tarsi somewhat darker.

*Undersurface*. Dark testaceous to black.

*Male abdomen*. Aedeagus (Fig. 459): median lobe short, well sclerotized, ending in a tube and with complicated structures of hooks and sclerites on the ventral side; distal to the median lobe lies a patch with sclerotized papillae or denticles, possibly a formation of the connecting membrane or the tegmen; tegmen with basal piece three times as long as apical piece. Retracted segment (Fig. 460): tergum with blunt hairy apex and proximal row of fenestrae; sternum consisting of a pair of slender sclerites with some apical hairs. Last exposed sternum (Fig. 461) apically bluntly pointed.

Material examined. South Africa: Matjesfontein [3320BA], 1–18.xii.1928, 1 ♂, 2 ♀♀, (R. E. Turner) (BMNH): Graaff Reinet [3224BC], x.1931, 1 ♀ det. R. F. Heberdey, (Miss A. Mackie) (NMW); Richtersveld, Nabas [2817AD], Malaise Trap, 17–18.ii.1979, 17 ♂♂, 3 ♀♀, (Lamoral, Bampton & Barnley) (AMSA). South West Africa: Okahandja [2116DD], xi.1927–i.1928, 3 ♂♂, 1 ♀, (R. E. Turner) (BMNH); 25 miles west of Helmeringshausen, Barby Farm [2551DC], to light, 17–18.i.1972, 1 ♂, (Southern African Expedition, British Museum) (BMNH); Aus [2616CB], 8–30.xi.1929, 2 ♂♂, 2 ♀♀, (R. E. Turner) (BMNH); 21 miles east of Swakopmund, Goanikontes [2214DB], 30.i.1972, 1 ♀, (Southern African Expedition, British Museum) (BMNH).

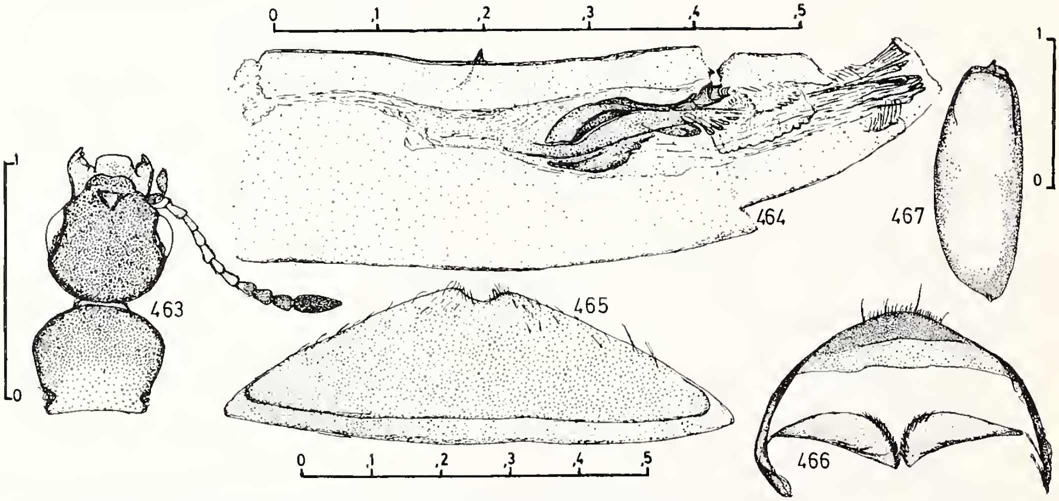
*Anthicus (Aulacoderus) obockianus* Pic, Figs 463–467
*Anthicus (Aulacoderus) obockianus* Pic, 1914a: 184

Size. Length 2,61 mm (2,50–2,69); width over broadest part of elytra 0,98 mm (0,92–1,03).

*Head* (Fig 463). Glossy, dark testaceous; posterior arch broadly round; punctures fine with short procumbent hairs. Eyes hardly bulging.

*Prothorax* (Fig. 463). Somewhat glossy, slightly lighter than head, with lighter basal area; broader than long, slightly broader than head; shoulders sloping and round; punctures denser than on head with fine recumbent hairs; lateral constrictions at $\frac{4}{5}$ of the length of the prothorax.

*Elytra* (Fig. 467). Mat, light testaceous with dark margins and dark along median suture, leaving the whole central area light testaceous, but with an indication of coalescence of anterior and posterior maculae; in the male specimen from Assab (or Aseb) there is a transverse



Figs 463–467. *A.* (*A.*) *obockianus* Pic. 463: head and prothorax. 464: aedeagus. 465: last exposed abdominal sternum of male. 466: retracted abdominal segment of male. 467: elytron of male.

dark bar separating anterior and posterior maculae as in Pic's description; very finely punctured with light recumbent hairs, hardly longer than on prothorax.

*Wings.* Fully developed.

*Antennae* (Fig. 463). Testaceous, four apical segments darker but hardly broader; apical segment longer than two preceding ones together.

*Legs.* Testaceous, coxae and femora slightly darker.

*Undersurface.* Testaceous.

*Male Abdomen.* Aedeagus (Fig. 464): median lobe short; genital opening not visible; on either side of median lobe is a dark sclerite which is broad at base and has four folds; these structures may be formations of the connecting membrane; tegmen: apical piece with a number of folds or bars at apex; the homology of these structures is not known; basal piece more than twice as long as apical piece. Retracted segment (Fig. 466): tergum with round apex; sternum consisting of a pair of sclerites with a fringe of recumbent hairs. Last exposed sternum (Fig. 465) with small apical indentation.

MATERIAL EXAMINED. Ethiopia: Katona, Assab (or Aseb), 1907, 1 ♂, 2 ♀♀ Krekich det., (no collector) (NMW); Katona, Gibdo, no date, 1 ♂ (no collector) (NHMP).

### *Anthicus (Aulacoderus) ganglbaueri* Pic, Figs 468–473

*Anthicus (Aulacoderus) ganglbaueri* Pic, 1900a, 139

Size. Length 2,35 mm (2,22–2,49); width over broadest part of elytra 0,81 mm (0,71–0,91).

*Head* (Fig. 473). Mat, testaceous; posterior arch broadly round; with fine punctures and short procumbent hairs. Eyes large, not much bulging.

*Prothorax* (Fig. 473). Mat, testaceous; broader than long, slightly narrower than head; shoulders round; punctures fine, hairs recumbent, longer and coarser than on head; lateral constrictions at ⅘ of the length of the prothorax, not connected by a transverse dorsal groove.

*Elytra* (Fig. 468). Mat, very light testaceous with three dark bands: one over the shoulder area, one across the middle and one at the apex; shape broad and flat; punctures very fine, recumbent hairs longer than on prothorax.

*Wings.* Fully developed.

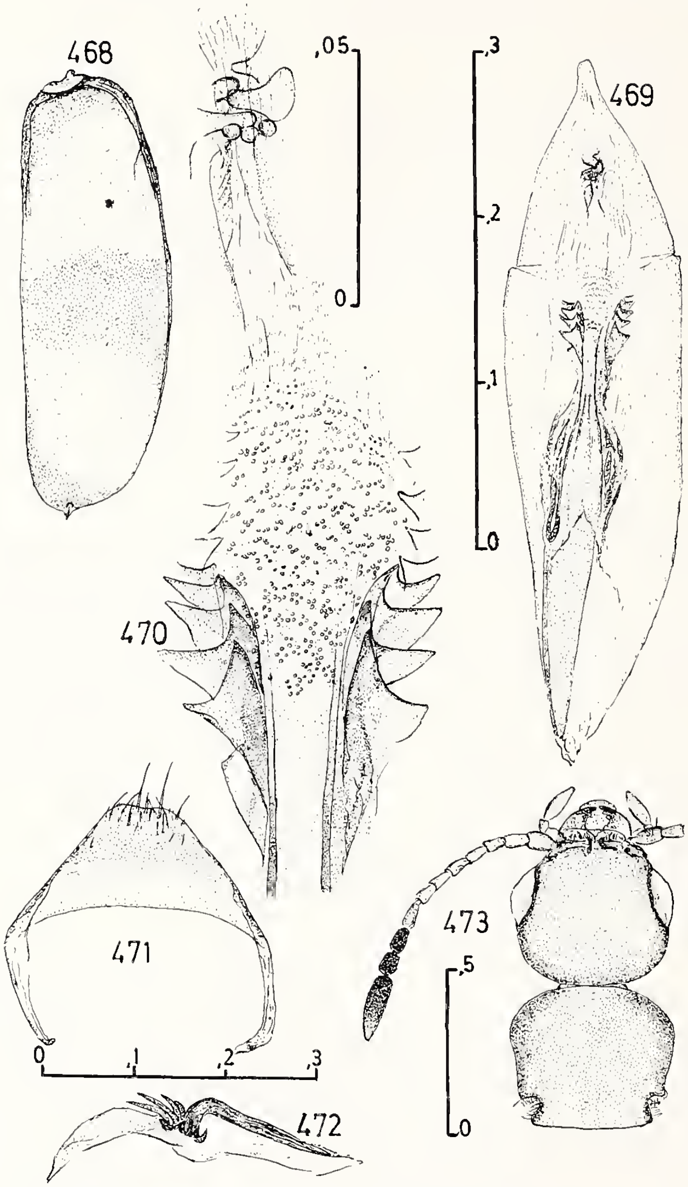
*Antennae* (Fig. 473). Slender, testaceous; last three segments dark, but not broader; last segment longer than two preceding ones together.

*Legs.* Testaceous.

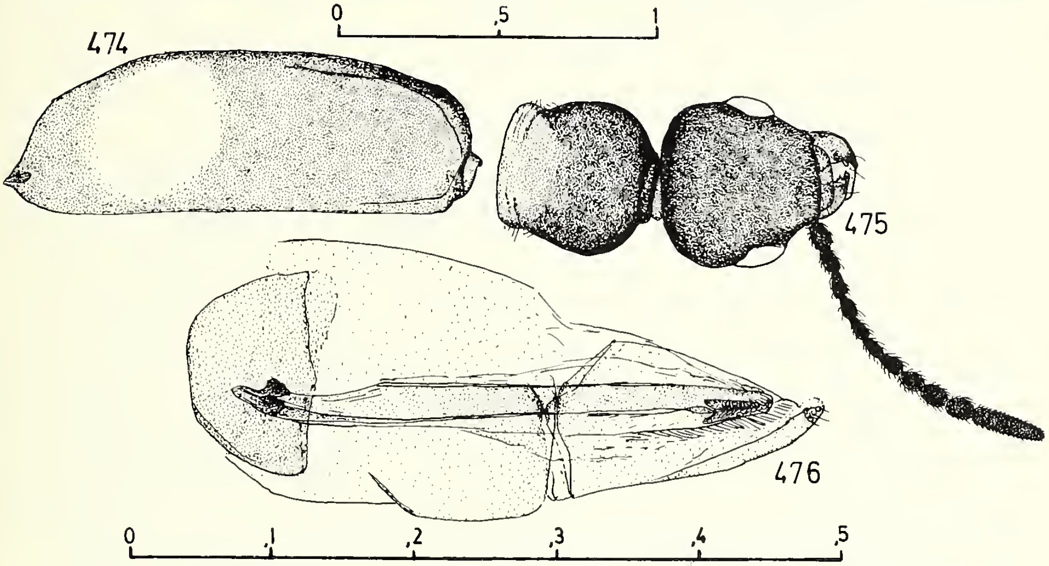
*Undersurface.* Testaceous; abdomen darker than thorax.

*Male abdomen.* Aedeagus (Figs 469 and 470): median lobe extends proximally to base of tegmen but distal end and genital opening are not clear; in this region is a set of four pigmented teeth on each side, resembling somewhat those occurring in *A.* (*A.*) *obockianus* (Fig. 464); these teeth may be a formation of connecting membrane; more distally the median region has a field of minute papillae with laterally a longitudinal row of pointed structures on each side which are neither pigmented nor sclerotized; distally the papillae fade out but there are even smaller indistinct groups of longitudinal folds; distal to these is a median group of about eight blunt finger-shaped papillae which are somewhat intertwined; they resemble the structures found in *A.* (*A.*) *techowi* (Fig. 459); tegmen little sclerotized, basal piece three times as long as apical piece. Retracted segment: tergum (Fig. 471) broad with apical hairs and without row of fenestrae; sternum (Fig. 472) consisting of a pair of slightly sclerotized plates which end in 4–5 pointed claw-like spines. Last exposed sternum very slightly indented at apex.

MATERIAL EXAMINED. Kenya: Tana, 1896, Types 2 ♂♂, Pic det., (no collector) (NMW).



Figs 468–473. *A.* (*A.*) *ganglbaueri* Pic. 468: elytron of male. 469: aedeagus. 470: detail of middle part of aedeagus. 471: tergum of retracted abdominal segment of male. 472: sternum of retracted abdominal segment of male. 473: head and prothorax.



Figs 474–476. *A.* (*A.*) *platypennis* spec. nov. 474: elytron of male. 475: head and prothorax. 476: aedeagus.

*Anthicus (Aulacoderus) platypennis* **spec. nov.**,Figs 474–476

Size. Length 2,34 mm (2,12–2,45); width over broadest part of elytra 0,93 mm (0,85–1,00).

*Head* (Fig. 475). Glossy, black; posterior arch broad; punctures fine with procumbent hairs. Eyes slightly bulging.

*Prothorax* (Fig. 475). Somewhat glossy, black; longer than broad, narrower than head; shoulders sloping and round; punctures as on head with recumbent hairs; lateral constrictions at $\frac{4}{5}$ of the length of the prothorax, small, with a few short hairs.

*Elytra* (Fig. 474). Glossy, dark testaceous to black, with a pair of light round maculae on posterior half; flat in shape (i.e. hardly convex); punctures fine with recumbent darkish hairs, somewhat lighter on the maculae; with a few erect hairs. Male with distinct apical point and elongate dark notch.

*Wings*. Fully developed.

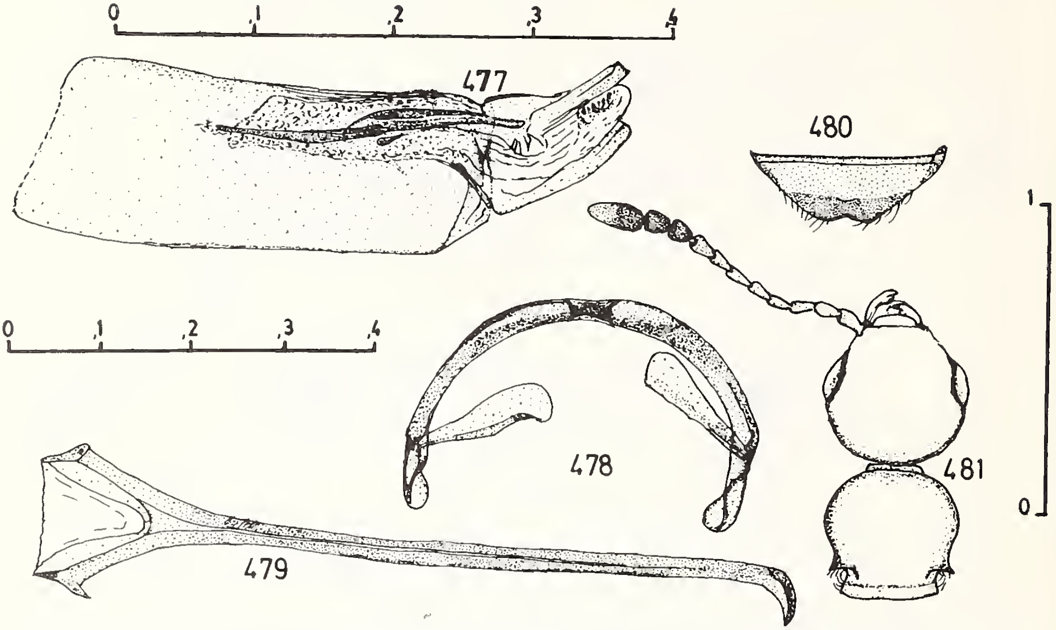
*Antennae* (Fig. 475). Very dark testaceous to black; apical segments hardly broader; last segment as long as two and a half of the preceding segments.

*Legs*. Dark testaceous.

*Undersurface*. Very dark testaceous; metasternum rather long.

*Male abdomen*. Aedeagus (Fig. 467): median lobe slender and straight with a pair of dark lobed tuberosities at base; genital opening with beaded margin and a dark elongate triangular sclerite on each side; connecting membrane without armature; tegmen lightly sclerotized: apical piece ending in a blunt dorsal point with a few apical hairs; basal piece one and a half times as long as apical piece. Retracted segment: tergum darkly pigmented with shallow apical indentation and transverse row of fenestrae directly distal to the well sclerotized proximal margin; sternum consisting of a pair of dark, rather broad triangular plates which overlap in the middle. Last exposed sternum with shallow apical indentation.

MATERIAL EXAMINED. South Africa: Willowmore [3323AD], no date, Holotype ♂, Paratypes 2 ♂♂, (Dr H. Brauns) (AMSA).



Figs 477–481. *A.* (*A.*) *lyonichoides* Kolbe. 477: aedeagus. 478: retracted abdominal segment of male. 479: spiculum gastrale of male. 480: last exposed abdominal sternum of male. 481: head and prothorax.

*Anthicus (Aulacoderus) lyonichoides* Kolbe, Figs 477–481
*Anthicus (Aulacoderus) lyonichoides* Kolbe, 1883: 278

Size. Length 2,20 mm; width over broadest part of elytra 0,80 mm.

*Head* (Fig. 481). Glossy, dark testaceous to black; posterior arch broadly round; punctures fine with short procumbent hairs. Eyes slightly bulging.

*Prothorax* (Fig. 481). Somewhat glossy, dark testaceous to black; as broad as long, narrower than head; shoulders sloping and round; punctures closer than on head with recumbent hairs; lateral constrictions at $\frac{5}{6}$ of the length of the prothorax, sharply marked anteriorly by overhanging points.

*Elytra.* Glossy, dark testaceous with two pairs of light testaceous maculae, reaching lateral margins but not median suture; punctures fine with fine light recumbent hairs and some erect hairs along median suture and lateral margins.

*Wings.* Fully developed.

*Antennae* (Fig. 481). Light testaceous, apical five segments progressively broader and darker; last segment longer than two preceding ones together.

*Legs.* Dark testaceous, tarsi lighter.

*Undersurface.* Dark testaceous.

*Male abdomen.* Aedeagus (Fig. 477): median lobe short and slender; genital opening apical, with finely beaded margin; connecting membrane with a longitudinal field of minute denticles; tegmen: apical piece short ending in a blunt central lobe and a pair of side lobes of equal length; basal piece more than three times as long as apical piece. Retracted segment (Fig. 478): tergum narrow and semi-circular with sharply marked darker median area; sternum consisting of a pair of thin narrow plates. Spiculum gastrale (Fig. 479) long and Y-shaped, each of the Y-arms ending in two points. Last exposed sternum (Fig. 480) apically indented.

MATERIAL EXAMINED. Guinea: Chinchovo, no date, Type ♂, Krekich det., (no collector) (NMW).

*Anthicus (Aulacoderus) picheyrei* Peyerimhoff, Figs 482–484
*Anthicus (Aulacoderus) picheyrei* Peyerimhoff, 1943: 16
*Aulacoderus manzer* Bonadona 1964: 242–244

Size. Length 2,04 mm (1,85–2,30); width over broadest part of elytra 0,80 mm (0,74–0,88).

*Head* (Fig. 482). Glossy, testaceous to dark testaceous; posterior arch broadly round; punctures fine and sparse with fine grey procumbent hairs. Eyes large and bulging, darkly margined, with rather large ommatidia.

*Prothorax* (Fig. 482). Glossy, testaceous; broader than long, narrower than head; punctures fine and sparse with fine grey recumbent hairs; lateral constrictions at $\frac{2}{3}$ of length of prothorax, very prominent and connected by a deep dorsal transverse groove with short hairs.

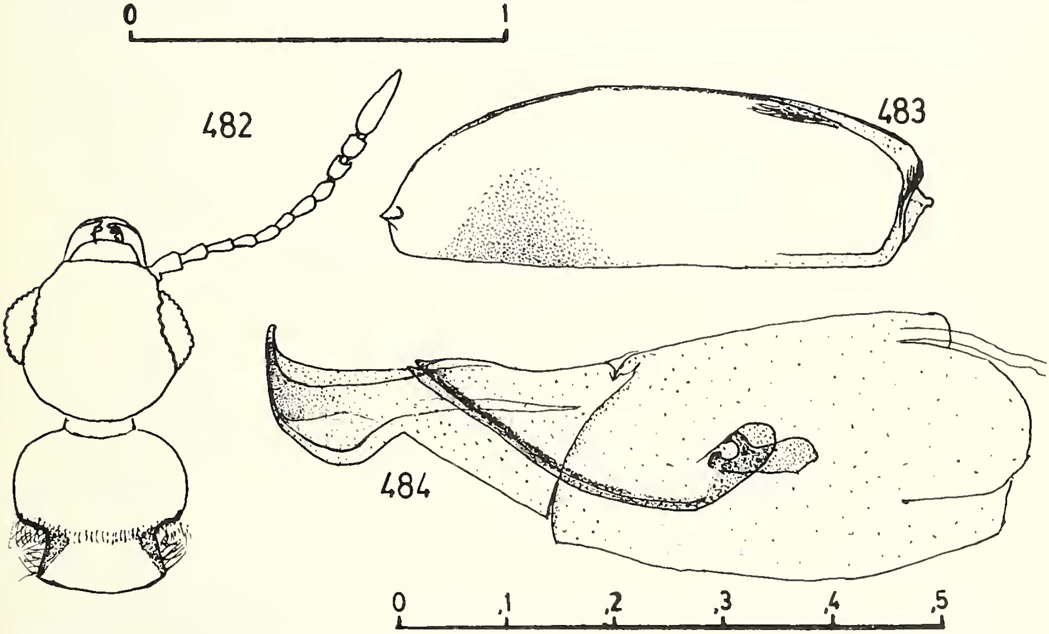
*Elytra* (Fig. 483). Glossy, light testaceous with a single dark mark at posterior quarter at median suture, not reaching lateral margins; punctures fine with recumbent hairs, slightly longer than on prothorax.

*Wings*. Fully developed.

*Antennae* (Fig. 482). Testaceous, apical segments not darker and hardly broader; last segment longer than two preceding ones together.

*Legs* and *undersurface*. Light testaceous.

*Male abdomen*. Aedeagus (Fig. 484): median lobe consists of a small short sclerite and a



Figs 482–484. *A.* (*A.*) *picheyrei* de Peyerimhoff. 482: head and prothorax. 483: elytron of male. 484: aedeagus.

long narrow strand which seems to be fused at its tip to the apical piece of tegmen; perhaps this strand represents connecting membrane of which there is no other evidence; tegmen with basal piece somewhat longer than apical piece which ends in a pair of curved dorsally pointing hooks. Retracted segment: tergum narrow and horseshoe-shaped; sternum consists of a pair of short narrow plates which are hardly sclerotized. Last exposed sternum with round apex.

MATERIAL EXAMINED. Algeria: Tamanrasset, Hoggar, ix.1941, Type ♂, (Dr Picheyre) (MNHN). Somali Republic: probably Dudar, 8 miles south of Berbera, x.1932, 2 ♂♂, (W. A. MacFadyen) (BMNH). Cameroun: Marona, x–xi.1956, 3 specimens, (G. Schmitz) (MRAC).

*Aulacoderus manzer* Bonadona, 1964, is described from the Sudan; Type ♂ (MNHN), Bigor Nohr. From the description and text figures it is obvious that *Aulacoderus manzer* is a synonym of *Anthicus (Aulacoderus) picheyrei* Peyerimhoff.

*Anthicus (Aulacoderus) sulcifer* Pic, Figs 485–488
*Anthicus (Aulacoderus) sulcifer* Pic, 1893: 54

Size. Length 2,25 mm (2,00–2,50); width over broadest part of elytra 0,83 mm (0,80–0,85).

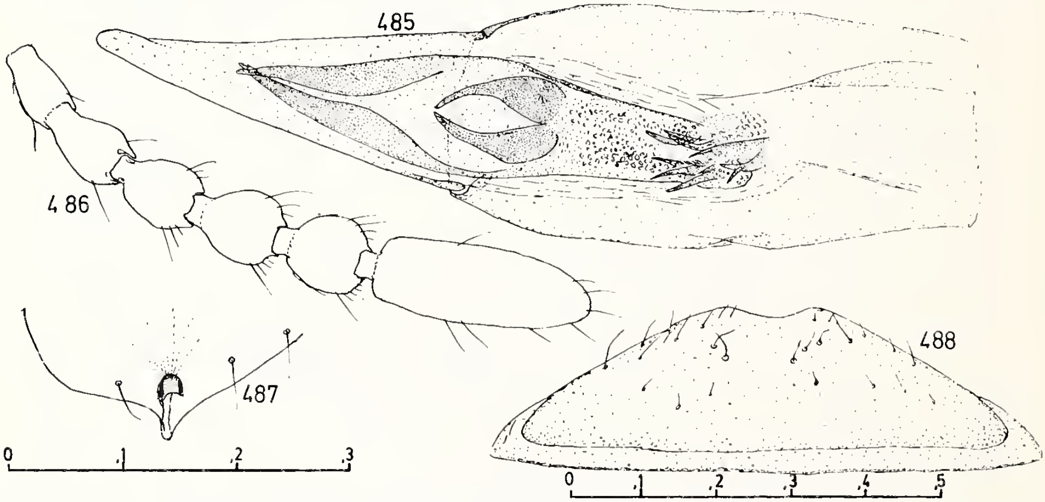
*Head.* Glossy, dark testaceous to black; posterior arch broadly round; punctures fine with fine procumbent hairs. Eyes large and bulging.

*Prothorax.* Glossy, dark testaceous with lighter posterior region; broader than long, narrower than head; punctures fine with recumbent hairs; lateral constrictions at ¾ of length of prothorax, connected by hairy dorsal transverse groove which separates the anterior region of the prothorax sharply from the posterior part.

*Elytra.* Somewhat glossy, dark testaceous on anterior half with transverse light band in the middle which extends forward along median suture; posterior area not as dark as anterior region; punctures distinct with recumbent hairs longer than those on prothorax. Male with rather elongate apical point with short notch (Fig. 487).

*Wings.* Fully developed.

*Antennae* (Fig. 486). Testaceous to dark testaceous; apical four segments somewhat dark-



Figs 485–488. *A.* (*A.*) *sulcifer* Pic. 485: aedeagus. 486: apex of antenna. 487: apex of elytron of male. 488: last exposed abdominal sternum of male.

er but not broader; last segment longer than the two preceding ones together, with almost parallel sides and blunt apex.

*Legs*. Testaceous, femora darker.

*Undersurface*. Dark testaceous.

*Male abdomen*. Aedeagus (Fig. 485): median lobe with a pair of long apical spines, a pair of shorter broader spines half-way along length and at base a group of about five short spines on each side; genital opening not visible; connecting membrane, surrounding base of median lobe, with small pustules; the scaly area on the proximal half of median lobe may also belong to connecting membrane; tegmen: apical piece with bluntly pointed apex; basal piece longer than apical piece. Retracted segment: tergum little sclerotized; sternum consists of a pair of long narrow sclerites. Last exposed sternum (Fig. 488) with shallow apical indentation.

MATERIAL EXAMINED. Algeria: Sahara, N. of El Golea, v.1912, 2 ♂♂, Krekich det., (Herbert & Hilg) (BMNH).

*Anthicus (Aulacoderus) sefrensis* Pic, Figs 489–490
*Anthicus (Aulacoderus) sefrensis* Pic, 1894b: 78

Size. Length 2,54 mm (2,30–2,78); width over broadest part of elytra 0,93 mm (0,78–1,04).

*Head* (Fig. 489). Glossy, dark testaceous to black; slender; posterior arch broadly round; with very fine punctures with short procumbent hairs. Eyes large and bulging.

*Prothorax* (Fig. 489). Somewhat glossy, testaceous; broader than long, as broad as head; shoulders sloping and round; punctures very fine with fine recumbent hairs, slightly longer than on head; deep lateral constrictions at $\frac{2}{3}$ of length of prothorax with long fine hairs and connected by dorsal transverse groove.

*Elytra*. Glossy, light testaceous to testaceous; usually somewhat darker on shoulder region and with dark transverse band, well behind middle; dark markings may be almost or completely absent in regressively coloured specimens; with very fine punctures with recumbent hairs, longer than on prothorax.

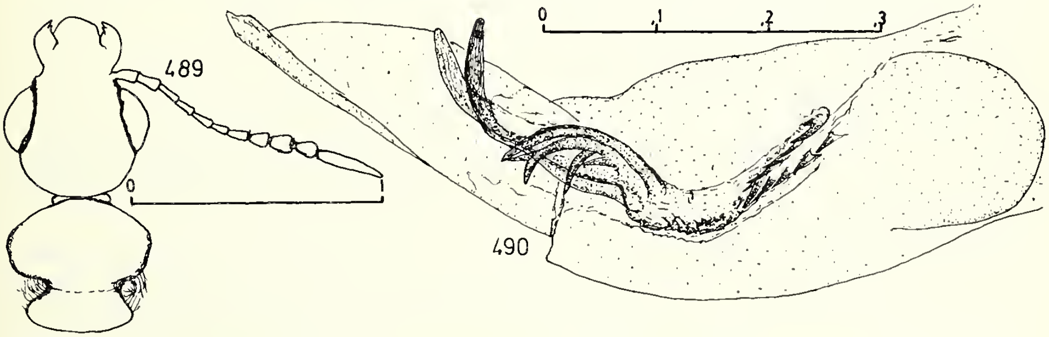
*Wings*. Fully developed.

*Antennae* (Fig. 489). Slender, testaceous; apical segments not darker but slightly broader; last segment as long as three preceding segments together.

*Legs*. Light testaceous.

*Undersurface*. Testaceous.

*Male abdomen*. Aedeagus (Fig. 490): median lobe with two blunt apical spines and four



Figs 489–490. *A.* (*A.*) *sefrensis* Pic. 489: head and prothorax. 490: aedeagus.

spines of different length in middle region of which one is forked; genital opening not visible; connecting membrane with some rather irregularly arranged teeth near attachment to base of median lobe; these teeth go over distally in a row of sclerotizations of indefinite shape; tegmen: basal piece one and a half times as long as apical piece. Retracted segment: tergum with flat apex; sternum consisting of a pair of thin plates. Last exposed sternum with flat apex.

MATERIAL EXAMINED. Southern Algeria: Ain Sefra, v.1896, 20 specimens, C. Koch det., (Dr A. Chobaut) (ZSBM).

This is not part of the Type material which was collected by M. Henon in 1893 at the same locality.

## SPECIES OF WHICH INSUFFICIENT MATERIAL WAS AVAILABLE FOR A COMPLETE DESCRIPTION

It was not possible to give a complete description of the following species because no male specimens were available for dissection. These species could therefore not be incorporated in the previous sections.

*Anthicus (Aulacoderus) alitienensis* Pic
*Anthicus (Aulacoderus) alitienensis* Pic, 1897a: 27

Size. Length 2,62 mm; width over broadest part of elytra 0,87 mm.

*Head*. Dark reddish testaceous; posterior arch broadly round; punctures rather coarse with short light procumbent hairs. Eyes bulging.

*Prothorax*. Glossy, reddish testaceous, lighter than head; as broad as long, slightly narrower than head; shoulders sloping, somewhat round; punctures closer and finer than on head with short light recumbent hairs; lateral constrictions between posterior third and quarter, with long light hairs and connected by a dorsal transverse depression parallel to base.

*Elytra*. Glossy, slightly lighter than prothorax; darker over shoulder region and with darker transverse band behind middle which is broadest at median suture, narrowing to lateral margins; punctures rather dense with light hairs which are longer than those on prothorax.

*Wings*. Fully developed.

*Antennae*. Reddish testaceous; apical three segments slightly broader but not darker; last segment as long as two preceding ones together.

*Legs*. Reddish testaceous.

*Undersurface*. Same colour as prothorax.

MATERIAL EXAMINED. Ethiopia: Alitiena, no date, Type ♀, (no collector) (MNHN).

*Anthicus (Aulacoderus) anteapicalis*, Pic
*Anthicus (Aulacoderus) anteapicalis*, Pic, 1938b: 71

Size. Length 2,75 mm; width over broadest part of elytra 1,02 mm.

*Head*. Glossy, black; posterior arch straightly transverse with round corners toward eyes; punctures fine with short light procumbent hairs. Eyes bulging.

*Prothorax*. Glossy, black, testaceous at base; broader than long, as broad as head; shoulders angular, each with an erect lateral hair; punctures closer than on head with recumbent hairs; lateral constrictions at $\frac{4}{5}$ of length of prothorax, with long hairs and connected by shallow dorsal transverse depression.

*Elytra*. Glossy, dark testaceous with two pairs of light maculae: anterior pair transverse, roughly rectangular, posterior pair small and indistinct; area between anterior and posterior maculae less dark than shoulder area; punctures fine with fine recumbent hairs and some erect hairs; on lateral half of anterior maculae is a patch of light hairs pointing obliquely outwards and backwards.

*Wings*. Fully developed.

*Antennae*. Dark testaceous, apical four segments darker and broader; last segment as long as two preceding ones together.

*Legs*. Dark testaceous, tibiae and tarsi lighter.

*Undersurface*. Dark testaceous.

Material examined. Basutoland (now Lesotho): no date, Type ♀, (no collector) (MNHN).

*Anthicus (Aulacoderus) collarti* Pic

*Anthicus (Aulacoderus) collarti* Pic, 1938a: 19

Size. Length 2,51 mm; width over broadest part of elytra 0,95 mm.

*Head*. Glossy, reddish testaceous; posterior arch broadly round; punctures fine with short light procumbent hairs. Eyes bulging.

*Prothorax*. Slightly lighter than head; broader than long, almost as broad as head; shoulders sloping and round; punctures fine with fine light recumbent hairs; lateral constrictions at $\frac{3}{4}$ of length of the prothorax, with long hairs and connected by a dorsal transverse depression.

*Elytra*. Light testaceous, dark over shoulder area and dark transverse band at apical quarter; middle area and apex light; punctures close with light recumbent hairs, slightly longer than those on prothorax.

*Wings*. Fully developed.

*Antennae*. Testaceous, apical four segments broader but not darker; last segment slightly longer than two preceding segments together.

*Legs*. Testaceous.

*Undersurface*. Testaceous, same colour as prothorax.

Material examined. Congo (now Zaire): Atshor à Tido, 3.iii.1929, Paratype ♀, (A. Collart) (MNHN).

*Anthicus (Aulacoderus) massarti* Pic

*Anthicus (Aulacoderus) massarti* Pic, 1952a: 79

Size. Length 1,87 mm; width over broadest part of elytra 0,70 mm.

*Head*. Glossy, dark testaceous; posterior arch broadly round; punctures fine and close with fine short procumbent hairs. Eyes small, somewhat bulging.

*Prothorax*. Mat, chagrinated, testaceous; as long as broad, narrower than head; with bluntly pointed shoulders; narrowing from shoulders to base; closely punctured with light recumbent hairs and lateral erect hairs on shoulders and halfway between shoulders and base; lateral constrictions hardly visible, with few hairs and connected by fine transverse dorsal groove.

*Elytra*. Somewhat glossy, light testaceous; short and broad, with well developed shoulders; punctures rather coarse with recumbent hairs, longer than on prothorax; some erect hairs along lateral margins.

*Wings*. Fully developed.

*Antennae*. Light testaceous; apical four segments broader but not darker; last segment shorter than two preceding ones together.

*Legs*. Testaceous.

*Undersurface*. Testaceous, darker than elytra.

Material examined. Ruanda: Astrida, iv.1938, Paratype ♀, (J. Ghesquière) (MNHN).

Although this specimen is labelled 'paratype', Pic is not sure of its identity. It does not

come from the Type locality: Zaire, Lomami, Kaniama, 3.vi.1932, R. Massart. The specimen carries two labels, both in Pic's handwriting:
(1) *Aulacoderus massarti* Pic var.
(2) *Massarti* Pic probable. Tête moins rétrécie en arrière que le type. Thorax moins brillant et plus large. Elytres moins larges.

Another difference is that the description gives the punctuation on the prothorax as 'non dense' while on the specimen examined it appears, to the present author, to be particularly dense.

*Anthicus (Aulacoderus) mohammedis* Mars.
*Anthicus (Aulacoderus) mohammedis* Marseul, 1879: 232

Size. Length 1,80 mm; width over broadest part of elytra 0,68 mm.

*Head.* Glossy, dark testaceous; posterior arch round; punctures fine with short light procumbent hairs. Eyes large, darkly margined, bulging and with large ommatidia.

*Prothorax.* Not very glossy, light testaceous; about as long as broad, almost as broad as head; shoulders sloping and round; punctures fine with light recumbent hairs, longer than on head; with prominent lateral constrictions at $\frac{2}{3}$ of the length of the prothorax and connected by dorsal hairy depression.

*Elytra.* Glossy, pale testaceous; with fine punctures and light recumbent hairs.

*Antennae.* Light testaceous; apical four segments somewhat broader; last segment as long as two preceding ones together.

*Legs.* Light testaceous.

*Undersurface.* Light testaceous.

MATERIAL EXAMINED. Arabia: Hedjaz, 1878 (?), Type ♀, (no collector) (MNHN).

This specimen looks similar to *A.* (*A.*) *picheyrei* but it seems to lack the median dark area on the elytra, perhaps due to the condition of the elytra or possibly by regressive colouration, for the dark mark is mentioned in Marseul's description. The resemblance of the eyes and the prothorax with its lateral constrictions is striking.

*Anthicus (Aulacoderus) sulcatulus* Pic
*Anthicus (Aulacoderus) sulcatulus* Pic, 1917: 10

Size. Length 2,50 mm; width over broadest part of elytra 0,75 mm.

*Head.* Glossy, testaceous to dark testaceous; posterior arch round; punctures prominent with light procumbent hairs. Eyes bulging.

*Prothorax.* Slightly glossy, testaceous, lighter than head; longer than broad, narrower than head; shoulders sloping and somewhat angular; punctures fine with light recumbent hairs, shorter than on head; lateral constrictions round and prominent connected by an inconspicuous transverse dorsal depression.

*Elytra.* Glossy, light testaceous to testaceous; shoulders prominent; punctures with light recumbent hairs longer than those on prothorax.

*Wings.* Fully developed.

*Antennae.* Slender, also the apical segments; last segment longer than two preceding ones together.

*Legs.* Testaceous.

*Abdomen.* Missing from the specimen examined.

MATERIAL EXAMINED. Kenya: Env. de Kalmosie, Forêt de Kakamegoes, Mt Elgon 2 000 m, no date, Type ♂, (no collector) (MNHN).

Pic mentions that this species is near *A.* (*A.*) *maynei* Pic but the shape of the antennae is different.

*Anthicus (Aulacoderus) sulcicollis* Pic
*Anthicus (Aulacoderus) sulcicollis* Pic, 1895c: 786

Size. Length 1,92 mm; width over broadest part of elytra 0,74 mm.

*Head.* Glossy, dark testaceous; posterior arch straight transverse with round angles to eyes; punctures fine with short procumbent hairs. Eyes little bulging.

*Prothorax.* Mat, lighter than head; longer than broad, narrower than head; shoulders sloping and round; punctures very fine with light recumbent hairs; lateral constrictions at $\frac{3}{4}$ of length of the prothorax, shallow and with a shallow transverse dorsal groove connecting the constrictions; an erect lateral hair on each shoulder.

*Elytra.* Glossy, testaceous, darker than prothorax but lighter than head; with a slightly lighter area on shoulders and light band on posterior half, not quite reaching median suture; punctures fine with light recumbent hairs, longer than on prothorax.

*Antennae.* Testaceous, last 3–4 segments darker and somewhat broader; last segment longer than two preceding ones together.

*Legs.* Testaceous, coxae and femora somewhat darker.

*Undersurface.* Dark testaceous.

Material examined. Afghanistan: no date, Type ♀. (no collector) (MNHN).

This specimen has another label: 'Perse (Doria) ♂ type'. The specimen is definitely ♀.

## SPECIES OF WHICH NO MATERIAL WAS AVAILABLE

The author has not been able to trace any specimens of the following species. He has no information about them apart from what is given in the descriptions.

*Anthicus (Aulacoderus) achillei* Pic, 1895a: 42
Described from 'Le Cap'.

It is possible that this species is the form of *A.* (*A.*) *bicoloritarsis* Pic with the pair of light maculae on the posterior half of the elytra. This form occurs in the area of the Cape of Good Hope and conforms to Pic's description of *A.* (*A.*) *achillei.*

*Anthicus (Aulacoderus) atrosuturalis* Pic, 1955: 94
Described from Kivu, Rutshuru, v.1938, J. Ghesquière.

*Anthicus (Aulacoderus) blechroides* Baudi, 1883: 150
Described from Israel, Tiberias.

The author has examined two specimens both of which were labelled *A.* (*A.*) *blechroides*, one Israel, Mikve Israel, 1931, 1 ♂ det. R. F. Heberdey, (F. S. Bodenheimer) (NMW) and the other Syria, Beirut, 1878, 1 ♂ det. v. Krekich, (NMW). Both specimens are *A.* (*A.*) *sulcithorax* Desbr., 1875. The specimen from Beirut has reduced wings but the same is known to occur as an inconstancy in other species of *Aulacoderus.* Baudi mentions the similarity of *A.* (*A.*) *blechroides* and *A.* (*A.*) *sulcithorax* but finds that the former is smaller, however, he gives no sizes. It is improbable that the elytra of both sexes should be pointed, as Baudi mentions, as in *Aulacoderus* only the males have pointed elytra.

*Anthicus (Aulacoderus) bouvieri* Pic, 1898: 71
Described from Obock, Lac Assal, 1893, Maindron.

*Anthicus (Aulacoderus) caffer* Fåhr., 1870: 335
Described from South Africa, Caffraria.

The author has seen one male specimen (National Museum of Natural History, Paris) which is labelled '*Anthicus caffer* Fåhr. doit être voisin. Port Elizabeth, no date, Dr Martin'.

This specimen is *A.* (*A.*) *flavopictus* Laf., described from South Africa, Cape of Good Hope. It occurs in a number of localities, all in the Cape Province, South Africa.

*Anthicus (Aulacoderus) ellenbergeri* Pic, 1938a: 251

*Anthicus ellenbergeri* Pic, 1920 was described from South Africa, Steynsburg [3125BD]. The author has seen a Type of this species (NMHN) which was collected by Dr F. Ellenberger in 1910; it is not an *Aulacoderus.*

In 1938 Pic described *Anthicus (Aulacoderus) ellenbergeri* from Lesotho (Basutoland), Leribé [2828CC]. The author has not seen a specimen of this species but judging from the description it probably is an *Aulacoderus* although Pic mentions that it should be placed near *Anthicus raffrayi* Pic, 1894a, which is not an *Aulacoderus* but a *Cyclodinus* from China.

*Anthicus (Aulacoderus) ferrantei* Pic

The author cannot find a description of this species. It is mentioned by de Peyerimhoff in the description of *A.* (*A.*) *picheyrei* as a species from Egypt and Central Sahara, straw-yellow, lighter in colour and smaller than *A.* (*A.*) *picheyrei* which is 2,5 mm long. According to de Peyerimhoff these two species are closely related to *A.* (*A.*) *sefrensis* Pic and *A.* (*A.*) *sulcifer* Pic. The author assumes that *A.* (*A.*) *ferrantei* Pic is a *nomen nudum.*

*Anthicus (Aulacoderus) friwaldszkyi* Laf., 1848: 267–268

The author has seen 3 ♂♂ and 2 ♀♀ (NMW) from Western Greece, Mesolongion, no date, no collector, labelled '*A. friwaldszkyi* Laf. det. v. Krekich'. One of the males has been dissected and was found to be *A. (A.) funebris* (Reitt.).

La Ferté described *A. (A.) friwaldszkyi* from Hungary and saw another specimen from Austria in the Collection Dejean where it was placed with specimens of *A. fuscus* Dej. (which is *A. caliginosus* Laf.) from Dalmatia and Tyrol. This last species is not an *Aulacoderus.*

Dr. Z. Kaszab, Budapest, informed the author (private communication) that to the best of his knowledge *A. (A.) friwaldszkyi* was never again collected in Hungary.

The descriptions of *A. (A.) friwaldszkyi* and *A. (A.) funebris* differ in two points: La Ferté mentions a yellow prothoracic base and a triangular scutellum for *A. (A.) friwaldszkyi* whereas Reitter describes *A. (A.) funebris* as black except for yellowish tarsi and the scutellum as semicircular. The specimens of *A. (A.) funebris* which the author has seen have no lighter prothoracic base. The shape of the scutellum is difficult to judge without dissection, as there is variation in how much is covered by prothorax in front and elytra laterally and posteriorly.

All specimens of *A. (A.) funebris* the author has seen came from around the Adriatic Sea. No specimens of *Aulacoderus* from Hungary or Austria have been seen.

There is no explanation why Krekich should have named the specimens from western Greece *A. (A.) friwaldszkyi*; none of the specimens was dissected.

*Anthicus (Aulacoderus) griseopubescens* Pic, 1920: 20

Described from Zaire.

*Anthicus (Aulacoderus) guinensis* Kolbe, 1883: 277

Described from Guinea inferior.

*Anthicus (Aulacoderus) luberosus* Pic, 1955: 74

Described from Kivu, terr. Lubero, 2 200 m, 30.ix.1951, N. Leleup, unique. Dans l'humus en forêt de bambous.

The author has described *A. (A.) humicola* spec. nov. also collected in Kivu in humus by Leleup, but the two species cannot be the same.

*Anthicus (Aulacoderus) maderae* Bonadona, 1963: 105–107

Described from Madeira, Ilheu de Cevada, 8.iv.1959, H. Lindberg: 1 ♀ (Museum Zoologicum, Helsingfors, Finland).

*Anthicus (Aulacoderus) mecheriensis* Chobaut, 1896: 376

Described from Algeria.

*Anthicus (Aulacoderus) okandjandensis* Pic, 1944: 10

Described from South Africa. The name indicates that this should be South West Africa; Okanjande [2016DA] is in Damaraland, South West Africa.

*Anthicus (Aulacoderus) quadrisignatus* La Ferté, 1848: 268–269

Described from South Africa, Prom. bon. Spei.

*Anthicus (Aulacoderus) semirubrotestaceus* Pic, 1914b: 487

Described from Zaire, Conga de Lemba, v.1911, R. Mayne.

## DISCUSSION OF THE INTERRELATIONS OF THE SECTIONS AND OF THEIR ZOOGEOGRAPHICAL DISTRIBUTIONS

Information on the subgenus *Aulacoderus* is, of course, far from complete. Of 22 described species incomplete or no material was available for description and there must be numerous undescribed species.

The greatest number of species is recorded from southern Africa, especially from South Africa where most intensive collecting has been done. Species from equatorial and northern Africa are sparingly represented in collections. Material from southern Europe, where only two species seem to occur, is well represented in various museums.

Mesepimerite apophyses are present in the species of Sections 1–14; in the species of Sections 15–19 they are absent.

The Albitarsis Group (van Hille, 1961), here represented by Sections 1–8, consists of species with an aedeagus which is little modified from the prototype of the coleopterous aedeagus as given by Sharp & Muir (1912). The main difference is the absence of the second connecting membrane (Figs 5–8). The aedeagus is elongate and the dorsal row of teeth of the first connecting membrane is typical of this Group. The eversion and retraction of the aedeagus can take place by change of hydrostatic pressure, caused by the movement of the abdominal segments. This is the dominant Group of *Aulacoderus* in southern Africa. Of the 67 species described in Sections 1–8, 90% occur in Africa south of 10° S latitude which includes South Africa, South West Africa, Zimbabwe, Mozambique, Malawi, Zambia and the greater part of Angola. The subdivision of the Group into 8 sections is based on secondary characteristics.

Section 9, consisting of two species from Zimbabwe, can be derived from the Albitarsis Group. The aedeagus is elongate and small and the dorsal row of teeth of the connecting membrane is absent. The sternum of the retracted abdominal segment is specialized and has two pairs of large hooks.

Section 10 consists of three South African species. The aedeagus is essentially different from that of the previous species. It is short and broad; the tegmen is broad and cucullate and the median lobe has hooks and spines. A connecting membrane is not visible and there is no evidence that the median lobe can move longitudinally in the tegmen. The species are small and wings are reduced or absent. The three species occur far apart: one in the S.W. Cape Province, one in northern Zululand and one in the Transvaal.

Section 11 consists of a single species. It has a short but not a very broad aedeagus which does not resemble that of any other species. The median lobe is u-shaped, the connecting membrane is not visible; the tegmen has a narrow pointed apical piece. This species occurs in Nigeria and Zaire.

Section 12. The four species have an elongate aedeagus and the connecting membrane has one large dorsal longitudinal hook with recurved apex. The last exposed abdominal sternum is divided into a left and right sclerite. The mesepimerite apophyses are reduced but present (Fig. 3). One species is from South West Africa, two from Zaire and one from the Sudan.

Section 13. The apical piece of the tegmen of the elongate aedeagus has a pair of parameres which do not occur in any of the other sections. One species is from South West Africa, one from Angola and one from Zaire.

Section 14. The median lobe of the elongate aedeagus has a ventral recurved hook. There are two bunches of elongate spines or hairs which are parallel to but not attached to the median lobe. The median lobe everts beyond the apex of the tegmen with the turning inside out of the connecting membrane. The last exposed abdominal sternum is specialized. One species is from South Africa and one from Zaire.

Sections 15–18 differ from all the previous sections in having no mesepimerite apophyses. Only Sections 15 and 16 are represented in South Africa; the majority of the species is from central and northern Africa and the Mediterranean region.

Section 15 represents the Martini Group (van Hille, 1961). The nine species in this section are closely related. The aedeagus is short and broad. The median lobe everts beyond the apex of the tegmen by the turning inside out of the connecting membrane which is unarmed. Characteristic for the species of this section is the sternum of the retracted abdominal segment of the male which consists of a pair of long backward pointing spikes which articulate with the base of the tergum of the retracted abdominal segment via a pair of more or less triangular sclerites. Three species occur in South Africa of which one is also found in South West Africa; four species are found only in South West Africa, one species is from Tanzania and one from Kenya and Eritrea.

Section 16 represents the Flavopictus Group (van Hille, 1961). The seven species of this section are closely related. The elongate aedeagus does not resemble that of any species of the preceding sections. The median lobe is membranous apart from a narrow longitudinal sclerite of which the pointed apex lies at the level of the genital opening. The base of this sclerite is somewhat broader and may be shortly forked; it is surrounded by an area with small pustules or denticles which probably represents the connecting membrane. The attachment of the connecting membrane to the tegmen cannot be seen. The median lobe with genital opening and sclerite can slide up and down in the tegmen but in no case the median lobe has been seen to evert beyond the apex of the tegmen. The mechanics of this movement are not known. Four species occur in South Africa, all in the Cape Province, one in Zimbabwe, one in the Sudan and one in Algeria.

Section 17. The three species of this section have an elongate aedeagus. In its middle lies a simple longitudinal sclerotized bar with an apical genital opening with finely beaded margin. It could be suggested that the longitudinal sclerite of the median lobe of the species of Section 16 had incorporated the genital opening and assumed the function of median lobe. Also here its base is surrounded by the connecting membrane which has pustules and (or) denticles. The connecting membrane ends in a ventral flap with folds and spines. When eversion takes place this flap folds double along the ventral surface of the aedeagus (Fig. 436) exposing the median lobe beyond the apex of the tegmen. This procedure of eversion is a modification of the method where the connecting membrane turns inside out (Albitarsis Group, Sections 14 and 15) and achieves the same result. One of the species occurs in Ethiopia, one in Ethiopia and Syria and one in Kenya.

Section 18. These two species are very similar. The aedeagus is elongate, the median lobe is membranous apart from a somewhat sclerotized base to which the connecting membrane is attached. The genital opening is elongate and has a beaded margin. As in Section 17 the connecting membrane ends in a ventral flap which folds double along the ventral side of the aedeagus when the median lobe everts (Fig. 444). Both species occur in southern Europe and no other species from this area have been seen. One species has an eastern distribution, the other a more western distribution. There is no evidence that these areas overlap.

Section 19 is not a group of related species but an assembly of species which do not fit in any of the previous sections. All species are without mesepimerite apophyses. *A.* (*A.*) *platypennis* from South Africa and *A.* (*A.*) *lyonychoides* from Guinea have an aedeagus of which the median lobe is a straight sclerotized bar with a terminal genital opening. In none of the other species the genital opening is visible and often it is impossible to identify the various parts of the aedeagus with certainty.

It seems that the most basic forms of the aedeagus of *Aulacoderus* are represented in the Albitarsis Group (Sections 1–8) of which the great majority of species occurs in southern Africa; many species have a strictly coastal distribution. However, also in South Africa there occur species in which the aedeagus is essentially different from and showing no relation to that of the Albitarsis Group, especially Sections 10 and 16 and to a lesser extent Sections 14 and 15. Further north in Africa and in southern Europe occur species in which the aedeagus shows a wide variety of structure. In some cases (Sections 17 and 18) there are indications about the method of eversion of the male genital tube but in several cases, althougth the structure of the aedeagus is known, its physiology is not understood.

Intensive collecting in equatorial and northern Africa should yield many more species which might elucidate the understanding of the homologies of the various parts of the aedeagus and the mechanics of its functioning.

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*Editor*
Dr F.W. GESS: 1978 –

# The smaller cetaceans of the south east coast of southern Africa

by

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## ABSTRACT

The small cetacean fauna of the south east coast of southern Africa is comprised of 24 species of odontocetes, including eight ziphiids (*Mesoplodon layardi, M. hectori, M. mirus, M. densirostris, M. grayi, Ziphius cavirostris, Berardius arnouxi, Hyperoodon planifrons*), two physeterids (*Kogia breviceps, K. simus*) and 14 delphinids (*Orcinus orca, Pseudorca crassidens, Feresa attenuata, Globicephala melaena, G. macrorhynchus, Grampus griseus, Tursiops truncatus, T. aduncus, Delphinus delphis, Stenella coeruleoalba, S. attenuata, S. longirostris, Lagenodelphis hosei, Sousa plumbea*). The taxonomy, biology and distribution in this region of these species are described, using new data from some 350 specimens, primarily strandings collected since 1968, about 400 sight records and supplemented with all previous records and published data.

The taxonomic status of 18 species is considered well-established or adequate. Further material from this region or elsewhere is required for a re-evaluation of the status of *B. arnouxi*, both species of *Tursiops*, the genus *Sousa* and southern African *Stenella attenuata* and *S. longirostris*. A key to the odontocetes of the south east coast is provided. Biological studies, incomplete for all species, are most advanced for *T. aduncus, D. delphis, S. coeruleoalba* and both *Kogia* species. The diversity within the small cetacean fauna is attributable to the variety of oceanographic conditions found off southern Africa. Four distributional components are described: a tropical/subtropical component, a temperate/subantarctic component, a component of cosmopolitan species, and a "mixed water" component consisting of a pair of species apparently locally limited in distribution to the southern coast of South Africa.

## INTRODUCTION

The taxonomy and biology of the majority of the cetaceans are relatively poorly known in comparison with present knowledge of terrestrial mammals, though the entire order of some 90 species comprises less than 1% of all described mammalian species (Walker, 1975a). The best known species are those which are hunted commercially or are involved indirectly in a commercial fishery such as the tuna-dolphin fishery in the eastern Pacific Ocean, since these activities can provide the series of material essential for comprehensive taxonomic and biological studies. The large balaenopterid whales and the sperm whale have been investigated intensively for several decades, primarily to provide the necessary data for formulating management policies for the whaling industry. However, similar studies on small cetaceans have been far less intensive and "less than ten stocks of even fewer species" of small cetaceans can be considered as well-known (Mitchell, 1975). For the remaining 55 species of small cetaceans, very little information is available. In the absence of direct exploitation such information has to be gleaned from animals stranded on the shore or from sight records at sea. This situation is true of the southern African species for there has been relatively little direct exploitation of small cetaceans in this region (Best and Ross, 1977).

The small cetacean fauna of southern Africa is extremely diverse, and 36 species are presently recorded from the region (Best, 1971; Perrin *et al.*, 1973; Ross, 1977). All but three of these are known from the south east (SE) coast of South Africa and include the 24 species of smaller odontocetes discussed in the present publication.

Though many of the species of this SE coast fauna were recorded during the 19th century from occasional specimens sent to European museums by collectors, the practice of describing new species based on single specimens without regard to individual variation led to a profusion of named forms. By 1900, nine of the 14 recorded small cetacean species (as currently recognized) had received one or more additional specific names based on material from this region. Many of these were later synonymized by more conservative taxonomists (cf. Flower, 1876; True, 1889), though they were still hindered by the small sample available for comparison. The status of other species such as *Delphinus capensis* Gray and *Phocoena edwardii* Smith could not be established due to lack of material.

Little additional material was collected during the first half of the present century but the nuclei of present marine mammal collections were established in South African museums during this period. These collections have been greatly expanded in the past two decades, primarily through improved conditions for receiving stranding reports and the subsequent collection of all available taxonomic and biological material. The success of this increased effort is reflected in the addition of six species, new to the southern African fauna, since 1959, by confirmation of the presence of a further three species unrecorded for over a century and by the acquisition of sufficient material for a reappraisal of the taxonomic status of most southern African small cetaceans.

Information presently available on the taxonomic status, biology and distribution is given in the present publication for the 24 species of small cetaceans known to occur on the SE coast from museum specimens and associated provenance data. The present publication is based on new data collected from approximately 350 stranded animals examined over some ten years from 1968, from sight records at sea and from observations on captive animals, and includes a review of the literature. For several reasons the scope of the publication has been limited to the small odontocete cetaceans of the south east coast of southern Africa. The large balaenopterid whales, particularly the fin whale *Balaenoptera physalus*, the sei whale *B. borealis* and Bryde's whale *B. edeni* and the sperm whale *Physeter macrocephalus* have been investigated intensively on the east and west coasts of South Africa (Best, 1974 and references therein; Gambell, 1972, 1974). The minke whale *Balaenoptera acutorostrata* is presently being studied by Dr P. Best, Sea Fisheries Branch, Cape Town using material collected from whaling operations off Durban since 1968 and from some stranded animals. The recovery of the southern right whale *Eubalaena australis* population is also being investigated (Best, 1974) and current information on the pygmy right whale *Caperea marginata* has been reviewed recently by Ross *et al.* (1975). No further information of significance on these species has become available since these publications and so they have been excluded from the present publication as further reviews would serve little purpose.

For the purposes of the present study the SE coast of southern Africa is arbitrarily defined as the area extending approximately 200 km seaward of the coastline between Mossel Bay (34° S, 22° E) and the Natal-Mozambique border (27° S, 33° E). These limits do not conform to those of the biogeographical regions described by Ekman (1967), but conveniently delimit the region in which most of the data have been collected. There are very few records of cetaceans for the whole of Mozambique or for the coast between Mossel Bay and Cape Agulhas (20° E), though note has been taken of available records where these are relevant to the distribution of a particular species.

The synonymy for each species has been abbreviated to the type description and references pertaining to the southern African region. As is customary in cetacean systematics, extensive comparative use of external and skeletal measurements has been made in the taxonomic treatments. In such comparisons difficulties were frequently encountered due to the paucity of suitable published data on material from elsewhere; measurements were often incomplete or given in a condensed form not applicable to many non-parametric statistical tests. Owing to the practical difficulties of transporting bulky material to the researcher or *vice versa* published measurements provide the most suitable alternative procedure and are likely to continue to do so in future. For this reason, measurements for each species have been tabled in the appendix to form a more effective base for future taxonomic revisions and for other studies such as growth or population studies using multivariate techniques (e.g. Machin, 1974).

The diversity of the cetacean fauna is one of the most interesting features of this region. Possible reasons for this diversity together with some factors that may limit the distribution of cetaceans are considered in the discussion.

## MATERIAL AND METHODS

### MATERIAL

The majority of material and data was obtained from stranded animals. Since the author was primarily dependent upon the public for reports of strandings, many of the animals examined were in a state of decomposition (and occasionally mutilation) which reduced the amount of available data and material. This collection was supplemented by specimens captured in the anti-shark nets off the Natal coast, occasional animals which died in captivity or during capture, a few specimens collected at sea for research purposes and some material already present in the East London Museum (ELM) and the South African Museum, Cape Town (SAM). All material has been registered in the collections of the Port Elizabeth Museum (PEM). Abbreviations of other institutions holding material discussed in this report are the Australian Museum, Sydney (AM), Western Australian Museum, Perth (WAM), the Museum of Comparative Zoology, Harvard College (MCZ), the United States National Museum, Washington (USNM), the American Museum of Natural History, New York (AMNH), the Peabody Museum of Natural History, Yale University (YPM), The Academy of Natural Sciences of Philadelphia (ANSP), the North Carolina State Museum (NCSM), British Museum (Natural History), London (BM) and the Zoologisch Museum, Amsterdam (ZMA).

Additional records were obtained from the files of the South African, East London and Port Elizabeth Museums, the Oceanographic Research Institute, Durban (ORI), and a number of newspaper files. Co-ordinates for all specimen or record localities are provided in Table 122.

Sight records were made from the shore or during several whale-marking cruises held off the SE coast (IOS, 1969, 1971, 1972, 1973, 1975; Gambell *et al.*, 1975) by the author and other experienced observers. The area surveyed during these cruises is shown in Fig. 43.

### MEASUREMENTS AND FORM

Standard external measurements were usually taken to the nearest 5 mm with a tape measure and are listed in Table 2 (after Norris, 1961). The intestine was separated from the mesentery and laid out on a level surface before measurement of its length.

Skull measurements were taken with calipers to the nearest millimetre, following those provided for beaked whales (Moore, 1963b) (Tables 3 and 4, Fig. 2), for *Kogia* (Ross, 1979, after van Bree; Table 5, Fig. 3) and for delphinids (Ross, 1977, after Fraser; Table 6, Fig. 4).

Vertebral counts were made directly on cleaned skeletons, when available. In counts made in the field the presence of seven cervical vertebrae was assumed and the number of ribs equated with the number of thoracic vertebrae. The articulations for the first chevron bone indicated the changeover from lumbar to caudal vertebrae.

Intact specimens or parts thereof were weighed on a variety of scales with appropriate ranges. The blubber posterior to the level of the occipital condyles was removed for weighing purposes and the combined mass of the epiaxial and hypoaxial fillets constitutes the meat mass. The heart was flushed of blood before weighing.

Illustrations of each species were drawn to scale by the author using colour transparencies and body measurements usually from a specific individual. Most specimens were chosen to represent the body form or colour pattern most typical for adults of the relevant species in the present region, except when a suitable local or adult specimen was not available.

### AGE DETERMINATION

The most suitable technique developed and used by a number of research workers in recent years, for determining the age of odontocetes, is based on the laminar deposition of dentine growth layers within the pulp cavity (Jonsgard, 1969). In the present study thin longitudinal sections or half teeth were prepared by sawing or flattening a tooth (selected for uniform

TABLE 1

Average monthly surface temperature (to the nearest °C) at six localities on the southern African coast. Data for Oro Point, Durban and False Bay are after Bass (1973). Those for East London (1972–1976) and Port Elizabeth (1962–1972) were supplied by the respective municipalities. Data for Plettenberg Bay (1972–1977) are averaged from the 10-day temperature charts produced by the Maritime Weather Office, Cape Town. A good correlation was obtained between these data and actual surf temperatures recorded at Plettenberg Bay by Mr. J. Collie for 32 periods of 8–10 days between 1972 and 1974.

| | January | February | March | April | May | June | July | August | September | October | November | December |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Oro Point ......... | 26 | 26 | 26 | 25 | 24 | 23 | 22 | 21 | 22 | 22 | 24 | 25 |
| Durban .......... | 24 | 24 | 24 | 23 | 22 | 19 | 19 | 19 | 20 | 21 | 22 | 23 |
| East London ...... | 19 | 18 | 18 | 17 | 18 | 17 | 17 | 18 | 18 | 17 | 18 | 19 |
| Port Elizabeth ..... | 22 | 21 | 20 | 18 | 17 | 16 | 16 | 15 | 16 | 17 | 18 | 20 |
| Plettenberg Bay ... | 20 | 19 | 18 | 18 | 17 | 16 | 15 | 15 | 16 | 16 | 18 | 19 |
| False Bay ......... | 18 | 18 | 16 | 16 | 14 | 14 | 13 | 13 | 13 | 14 | 15 | 17 |

TABLE 2:

External body measurements taken for this study (after Norris, 1961).

1 Total length, from tip of upper jaw to deepest part of notch on flukes.
2 Tip of upper jaw to centre of eye.
3 Tip of upper jaw to apex of melon.
4 Tip of upper jaw to angle of gape.
5 Tip of upper jaw to external auditory meatus.
6 Centre of eye to external auditory meatus.
7 Centre of eye to angle of gape.
8 Centre of eye to centre of blowhole.
9 Tip of upper jaw to blowhole.
10 Tip of upper jaw to anterior insertion of flipper.
11 Tip of upper jaw to anterior insertion of dorsal fin.
12 Tip of upper jaw to tip of dorsal fin.
13 Tip of upper jaw to midpoint of umbilicus.
14 Tip of upper jaw to midpoint of genital aperture.
15 Tip of upper jaw to midpoint of anus.
16 Projection of lower jaw beyond upper jaw.
17 Tip of upper jaw to posterior extremity of throat creases.
18 Thickness of blubber at *(a)* mid-dorsal at anterior insertion of dorsal fin, *(b)* mid-lateral at mid-length, *(c)* mid-ventral at mid-length.
19 Length of throat creases *(a)* left, *(b)* right.
20 Girth on a transverse plane intersecting axilla.
21 Girth, maximum.
22 Girth on a transverse plane intersecting anus.
23 Length of eye.
24 Length of mammary slits *(a)* left, *(b)* right.
25 Length of *(a)* genital slit, *(b)* anal opening, *(c)* ano-genital slit.
26 Width of blowhole.
27 Length of flipper, anterior insertion to tip.
28 Length of flipper, axilla to tip.
29 Maximum width of flipper.
30 Height of dorsal fin.
31 Length of dorsal fin base.
32 Width of flukes, tip to tip.
33 Distance from nearest point on anterior border of flukes to notch.
34 Depth of notch between flukes.

shape when possible) antero-posteriorly on a grindstone prior to hand-grinding to a thickness of approximately 0,2–0,3 mm using 220- and 400-grade Carborundum wet paper. Growth layers were counted at magnification up to 10 times using reflected light or transmitted light, while the tooth was dry or immersed in water or alcohol, depending on which gave the best legibility or matched the technique used by workers elsewhere for a particular species.

Some of the limitations of the technique in southern African *Kogia* and *Tursiops aduncus* have been described elsewhere (Ross, 1977, 1979). Two limitations of this technique are the closure of the pulp cavity and the formation of illegible secondary dentine prior to closure (Ross, 1977). The most important limitation is the lack of information on dentine deposition rate. Several studies suggest that one layer is deposited annually in *Physeter macrocephalus* (Best, 1970), *Tursiops truncatus* (Sergeant *et al.*, 1973), *Stenella coeruleoalba* (Kasuya, 1976; Miyazaki, 1977) and *S. attenuata*, (Kasuya *et al.*, 1974). Studies by Perrin *et al.* (1976) on *S. attenuata,* however, suggested that two layers were deposited in the first year and one per year thereafter whereas one-and-a-half layers appeared to be laid down in the first year in *S. longirostris* and thereafter the deposition rate was conjectural (Perrin *et al.*, 1977a). As a result of this uncertainty ages in the present study are expressed only as numbers of growth layers for most species.

Fusion of the epiphyses to the centra of mid-thoracic vertebrae indicated the attainment of physical maturity.

Table 3:

Descriptions of cranial measurements taken of beaked whales for this study (after Moore, 1963b), and illustrated in Fig. 2.

1 Condylobasal length.
2 Length of rostrum, tip of beak to line connecting apices of antorbital notches.
3 Tip of rostrum to posterior margin of pterygoid near midline.
4 Tip of rostrum to most posterior extension of wing of pterygoid.
5 Tip of rostrum to most anterior extension of pterygoid.
6 Tip of rostrum to most posterior extension of maxillaries between pterygoids on the palate.
7 Tip of rostrum to most posterior extension of maxillary plate.
8 Tip of rostrum to anterior margin of superior nares.
9 Tip of rostrum to most anterior point on premaxillary crest.
10 Tip of rostrum to most posterior extension of temporal fossa.
11 Tip of rostrum to most posterior extension of lateral tip of premaxillary crest.
12 Tip of rostrum to most anterior extension of ptyergoid sinus.
13 Length of temporal fossa.
14 Length of orbit.
15 Length of right nasal on vertex of skull.
16 Length of nasal suture.
17 Breadth of skull across postorbital process of frontals.
18 Breadth of skull across zygomatic processes of squamosals.
19 Breadth of skull across centres of orbits.
20 Least breadth of skull across posterior margins of temporal fossae.
21 Greatest span of occipital condyles.
22 Greatest width of an occipital condyle.
23 Greatest length of an occipital condyle.
24 Greatest breadth of foramen magnum.
25 Breadth of skull across exoccipitals.
26 Breadth of nasals on vertex.
27 Least distance between premaxillary crests.
28 Greatest extension of right premaxillary posterior of right nasal on vertex of skull.
29 Greatest span of premaxillary crests.
30 Least width (strictly transverse) of premaxillae where (and if) they narrow opposite superior nares.
31 Greatest width of premaxillae anterior to place of measurement no. 30.
32 Width of premaxillae at midlength of rostrum.
33 Width of rostrum in apices of antorbital notches.
34 Width of rostrum in apices of prominential notches (if any).
35 Greatest width of rostrum at midlength of rostrum.
36 Greatest depth of rostrum at midlength of rostrum.
37 Greatest transverse width of superior nares.
38 Greatest inside width of inferior nares, at apices of pterygoid notches, on the pterygoids.
39 Height of skull. Distance between vertex of skull and most ventral point on pterygoids.
40 Greatest width of temporal fossa approximately at right angles to greatest length.
41 Least distance between (main or anterior) maxillary foramina.
42 Least distance between premaxillary foramina.
43 Distance from posterior margin of left maxillary foramen to most anterior extension of left maxillary prominence.
44 Greatest length of vomer visible at surface of palate.
45 Amount added to beak because of breakage.
46 Length of tympanic bulla, left.
47 Length of tympanic bulla, right.

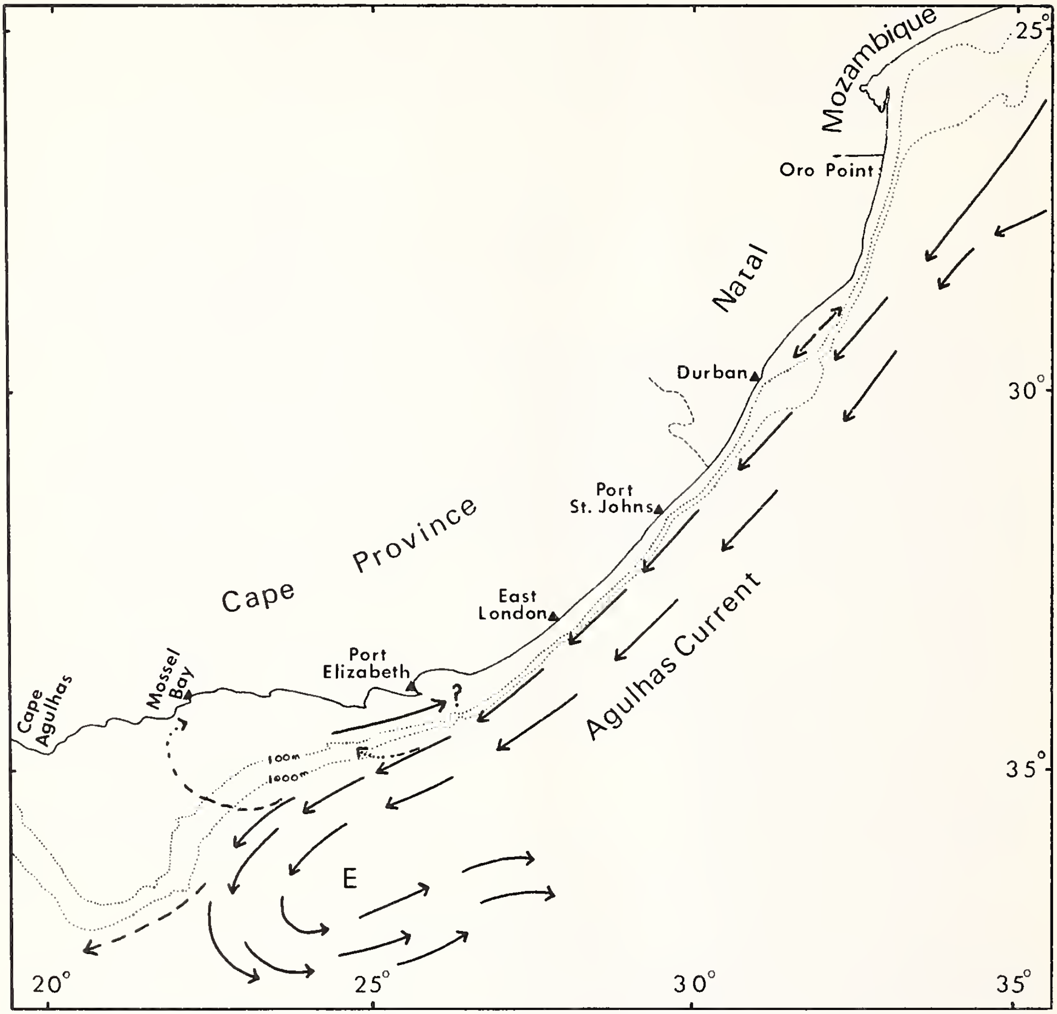


Fig. 1. The distribution of the Agulhas Current, the initial portion of the Agulhas Return Current and the enclosed permanent eddy (E) described in the text. Dashed lines indicate intermittent westward and inshore flow of Agulhas Current water. The inshore current in Natal coastal waters undergoes periodic reversals in direction; similar changes in current flow may also occur in eastern Cape coastal waters.

## Reproduction

Females with one or more corpora in their ovaries were classed as sexually mature. Ovaries were weighed after preservation in 10% formalin, and measured in three perpendicular planes. Each ovary was sliced at approximately 2–3 mm intervals with a scalpel. Corpora lutea and corpora albicantia were counted and measured in three perpendicular planes. The product of these measurements is given as a corpus albicans index.

TABLE 4:

Descriptions of mandibular and tooth measurements taken of beaked whales for this study (after Moore, 1963b), and illustrated in Fig. 2.

1 Length of mandible.
2 Greatest length of symphysis.
3 Height of mandible at coronoid process.
4 Outside height of mandible at midlength of alveolus.
5 Inside height of mandible at midlength of alveolus.
6 Length from most posterior extension of symphysis to most posterior extension of condyle.
7 Length from posterior margin of alveolus to condyle.
8 Length of alveolus.
9 Width of alveolus.
10 Tip of mandible to alveolus.
11 Greatest length of tooth.
12 Greatest antero-posterior width of tooth at approximately right angles to long axis of tooth.
13 Greatest breadth of tooth.

Females with visible milk in the cut mammary gland were classed as lactating. Neonatal animals were identified by the presence of pale birth creases on the body, an incompletely healed umbilicus, appendages which lacked rigidity and were curled over, and vibrissae along the snout.

Males were classed as sexually mature on the presence of spermatozoa in the testis, though spermatozoa found in the epididymis are probably a better indication of functional ma-

TABLE 5:

Descriptions of measurements taken of skulls of *Kogia* for this study, and illustrated in Fig. 3.

1 Total (condylobasal) length.
2 Rostrum length*.
3 Basal width of rostrum*.
4 Width of rostrum at its midlength*.
5 Breadth across pre-orbital angles of supra-orbital processes.
6 Breadth across post-orbital processes of frontals.
7 Breadth of skull across zygomatic processes of squamosals.
8 Height of vertex.
9 Width of vertex.
10 Width of supra-occipital at narrowest part between posterior margins of temporal fossae.
11 Tip rostrum to anterior border of left naris.
12 Height of ventral border of foramen magnum.
13 Length maxillary tooth groove, right.
14 Length maxillary tooth groove, left.
15 Width between outer margins of occipital condyles.
16 Tip of rostrum to hind margin of pterygoids near the midline.
17 Length of mandible.
18 Number of alveoli, left.
19 Number of alveoli, right.
20 Height of mandible at coronoid process.
21 Length of mandibular symphysis.
22 Length of tooth row, lower left.
23 Length of tooth row, lower right.
24 Height dorsal border of foramen magnum to vertex.
25 Length, anterior margin mesorostral ossification to anterior border of left naris.

* Measured ventrally.

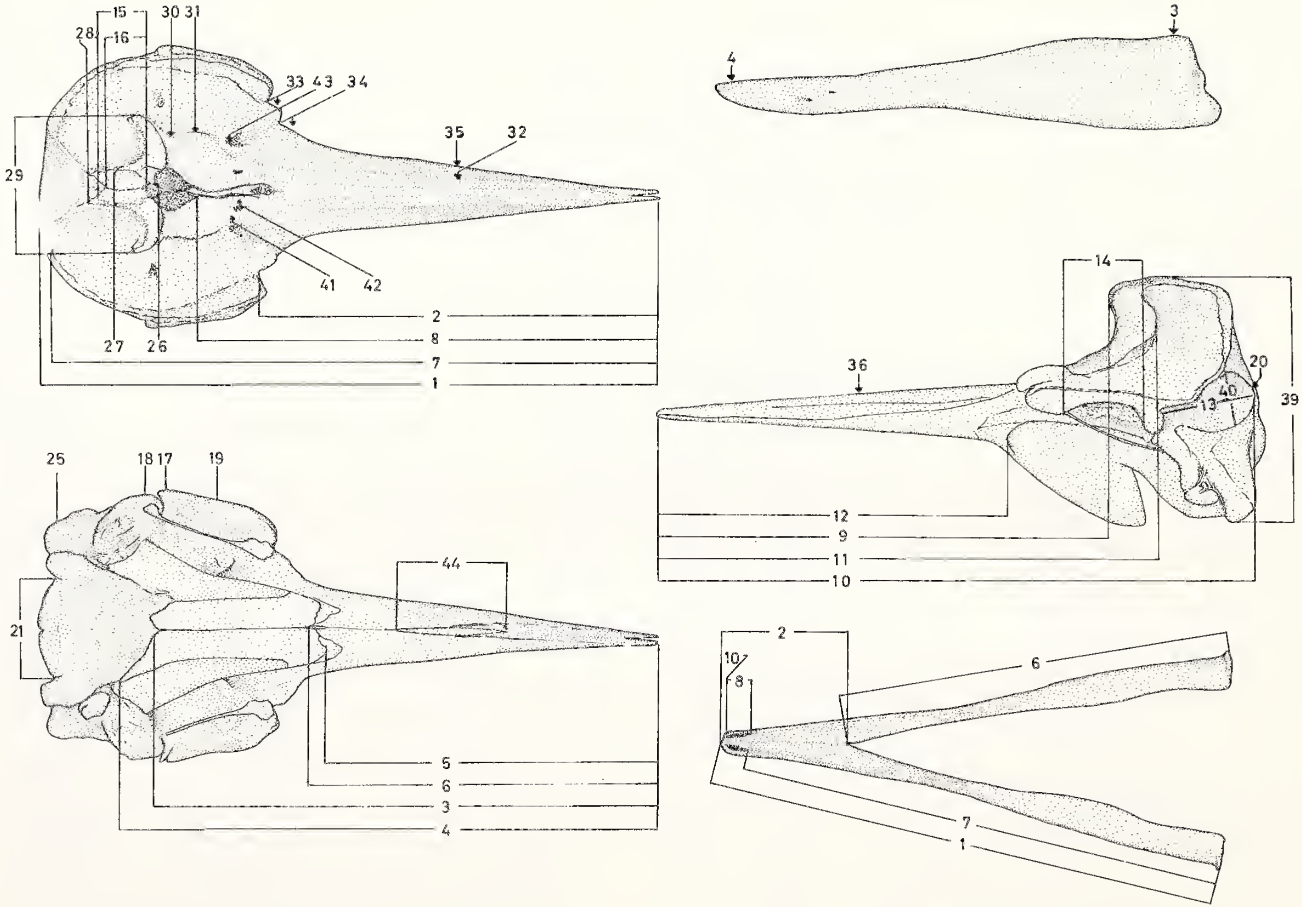


Fig. 2. Measurements taken of beaked whale skulls for this study, as listed in Tables 3 and 4.

turity. Testis length and two diameters at right angles were taken. Segments or small cubes of central tissue at midlength of the testis were preserved in 10% formalin, embedded in paraffin wax (MP 54° C), sectioned at 7–10 $\mu$ thickness and stained with haemotoxylin. The minimum diameters of 30 tubules were measured with an eyepiece micrometer to determine the mean tubule diameter.

### Food and Feeding

Almost all prey items collected from stomachs of stranded animals were well digested, though intact items were frequent in captured animals. The majority of prey identifications were made using fish otoliths and the lower mandibles or beaks of cephalopods. These were recovered by thoroughly flushing the stomach into a tray with water and removing the smaller fragments of the contents by gently overflowing the tray. Beaks were stored in 10% formalin and otoliths were stored dry.

Table 6:

Descriptions of skull measurements taken of delphinids for this study and illustrated in Fig. 4.

| | |
|---|---|
| 1 | Condylobasal length. |
| 2 | Rostrum length. |
| 3 | Basal width of rostrum. |
| 4 | Width of rostrum 60 mm anterior to antorbital notches. |
| 5 | Rostral width at midlength. |
| 6 | Width of premaxillae at midlength of rostrum. |
| 7 | Tip of rostrum to anterior border of superior nares. |
| 8 | Tip of rostrum to posterior border of pterygoids close to the midline. |
| 9 | Breadth of skull across preorbital processes of frontals. |
| 10 | Breadth of skull across postorbital processes of frontals. |
| 11 | Breadth of skull across centres of orbits. |
| 12 | Breadth of superior nares. |
| 13 | Breadth of skull across zygomatic processes of squamosals. |
| 14 | Maximum width of premaxillae proximally. |
| 15 | Width of braincase between posterior borders of temporal fossae. |
| 16 | Number of teeth, upper right. |
| 17 | Number of teeth, upper left. |
| 18 | Length of tooth row upper right. |
| 19 | Length of tooth row upper left. |
| 20 | Posterior end of upper tooth row to tip of premaxillae, right. |
| 21 | Posterior end of upper tooth row to tip of premaxillae, left. |
| 22 | Number of teeth, lower right. |
| 23 | Number of teeth, lower left. |
| 24 | Length of tooth row, lower right. |
| 25 | Length of tooth row, lower left. |
| 26 | Posterior end of lower tooth row to tip of mandible, right. |
| 27 | Posterior end of lower tooth row to tip of mandible, left. |
| 28 | Length of mandible. |
| 29 | Depth of mandible at coronoid process. |
| 30 | Length of mandibular symphysis. |
| 31 | Length of temporal fossa. |
| 32 | Height of temporal fossa, perpendicular to No. 31. |
| 33 | Width of rostrum at one quarter of rostral length from the tip. |
| 34 | Height of cranium between basioccipital and the vertex. |
| 35 | Maximum length of tympanic bulla, right. |
| 36 | Maximum length of tympanic bulla, left. |

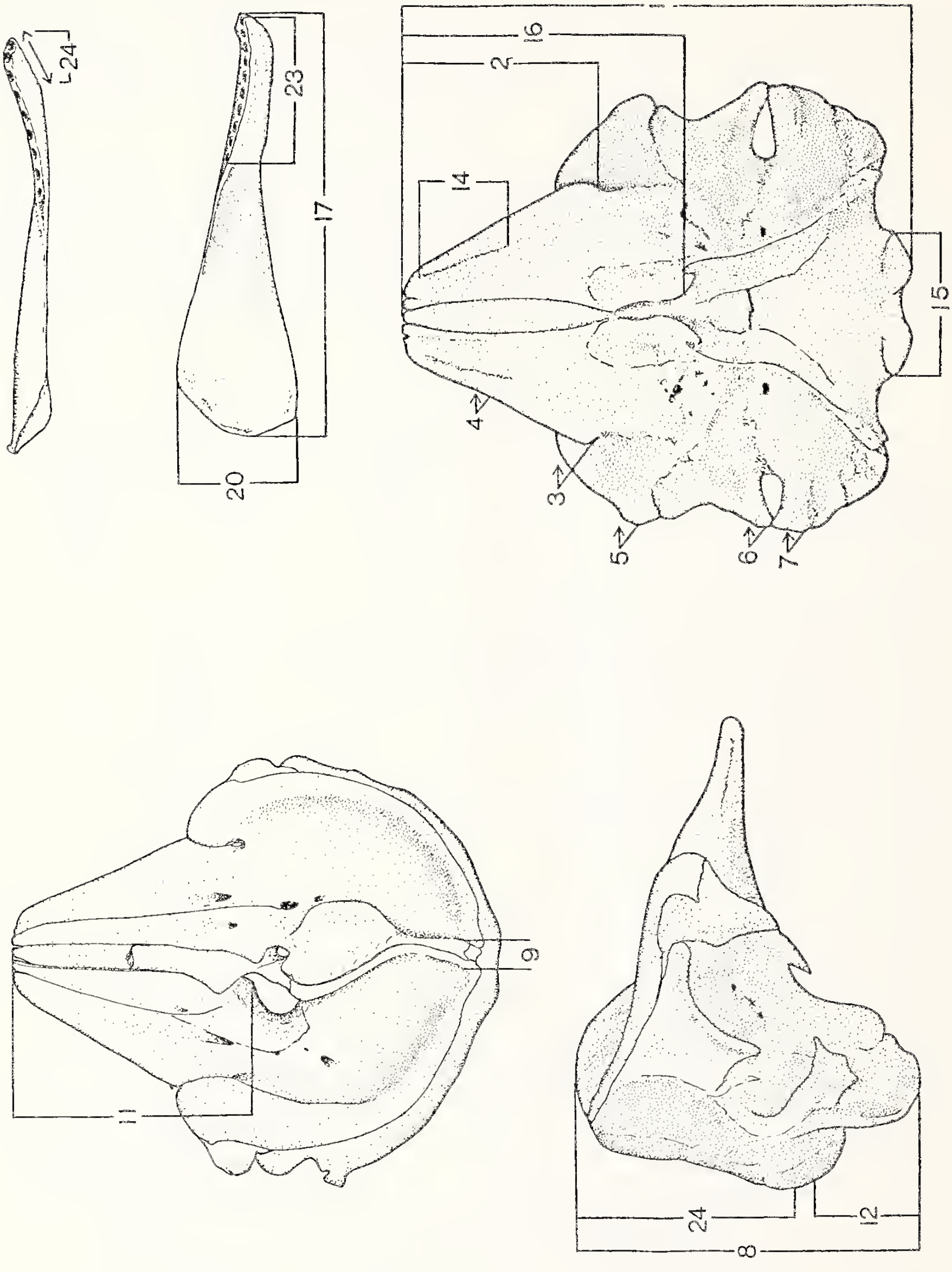


Fig. 3. Measurements taken of *Kogia* skulls for this study, as listed in Table 5.

Otoliths of the majority of inshore fishes were identified by comparison with a reference collection of some 450 species which was initiated by the author for this project. Oceanic fishes are still poorly represented in this collection and otoliths from these fishes were kindly identified by Mr J. Fitch, Department of Fish and Game, California.

Cephalopod beaks were identified by comparison with a set of reference specimens originally identified by Mr N. MacLeod, Institute of Oceanographic Sciences, U.K. for a study on *Kogia* species (Ross, 1979), supplemented by reference beaks from the cephalopod collection in the South African Museum. Beaks from lycoteuthid squids were identified as *Oregoniateuthis* from material provided by Mr M. Imber, Wildlife Service, Wellington, New Zealand.

The relegation of a group of beaks to a family has been tentative in some instances, e.g. those referred to as chiroteuthid type 3; histioteuthid types 7 and 8 have the ridge on the lateral wall which is typical of this family, but the wings are atypical, and Cranchiid types 1 and 2 are similar to beaks of *Taonius* and gonatids respectively. At the generic level, a number of small enoploteuthid beaks were assigned to the genera *Abralia* and *Abraliopsis* by comparison with single specimens of *Abralia veranyi* and *Abraliopsis gilchristi.*

### PARASITES

Identifications of parasitic helminths were made by Dr D. I. Gibson, British Museum, London.

## PHYSICAL FEATURES OF THE REGION

The description of the major physical features of the SE coast of Africa has been collated from papers by Bang (1970), Harris (1970), Flemming (1976), Bang and Pierce (1976) and Wyrtki (1973).

### HYDROLOGICAL FEATURES

The Agulhas Current is the most prominent oceanic feature of the region (Fig. 1). Originating from a combination of water from the south Equatorial Current flowing through the Mocambique Channel and water flowing down the east coast of Madagascar, the Agulhas Current is a narrow fast flow along the SE coast of South Africa. It has an average velocity of about 1 m/sec and frequently exceeds 2 m/sec at its core. It is approximateldy 100 km wide between the 0,5 m/sec isotachs. Between Durban and Port Elizabeth it flows close to the shore, with parts of it over the continental shelf and the core often over the continental slope. Between East London and Port Elizabeth it begins to diverge from the coast, veering south before encountering the edge of the Agulhas Bank and finally eastwards to form the Agulhas Return Current. The eddy formed between the Agulhas and the Agulhas Return Currents is a permanent feature situated approximately 300 km offshore, and is filled with warm, subtropical surface water to a depth of about 500 m. Eddies are frequently shed from the main anticyclonic flow and these drift westward into the Atlantic Ocean. There is no direct and continuous flow of subtropical water between the Indian Ocean and the Atlantic Ocean.

The surface temperature of the Agulhas Current varies seasonally between 22° C in August and 27° C in March. The surface water is a mixture of Tropical Surface Water originating in the South Equatorial Current and Subtropical Surface Water, with a typical surface salinity of 35,2 to 35,4‰. Under these surface water masses lies Central Water from about 200 m to 800 m depth, and temperature decreases steadily with depth.

The hydrography of coastal waters between the inshore edge of the Agulhas Current and the coastline is complex and is not very well known. The surface waters over the Agulhas Bank are well-mixed in the upper 50 m, and are subject to wide seasonal fluctuations in temperature and salinity. The average temperature in the upper 50 m varies between 15° C in August and about 20° C in February. Central Water spreads up the continental slope and over the shelf, occasionally reaching the surface and the coastline. Intense coastal upwelling can induce extreme drops in temperature, and de Decker (1973) records a surface temperature of 6° C in February 1970 a few miles off the coast near Knysna. Average monthly temperatures for a number of points on the coasts of South Africa are given in Table 1. Water temperatures at these points vary seasonally about 2–6° C, reaching a maximum in January—February, and a minimum in July—August. Water temperatures decline rapidly south-westwards along the exposed SE coast as far as Algoa Bay, from an annual mean of 23,8° C at Oro Point to 17,9° C at East London. Further west, the sheltered bays of the eastern Cape coast show a greater seasonal variation in water temperature than at East London. However the annual mean temperatures at Algoa Bay (18 ° C), Plettenberg Bay (17,2° C) and East London are remarkably similar, suggesting that locally-warmed waters in these bays effectively extend the warm influence of the Agulhas Current on the coast, perhaps as far west as Mossel Bay.

Bang (1970) has suggested that a series of tight cyclonic eddies rolling along the inshore edge of the Agulhas Current expands and progressively destroys the Current-bounding convergence west of about 25° E, with mixing of Agulhas and Bank waters. At about 22° E the Current boundary disappears, allowing Agulhus water to move across the Agulhas Bank and then turn eastwards, forming a countercurrent inshore. East of Port Elizabeth strong divergence suggesting upwelling has been observed inshore of the Agulhas Current edge, thought to have been the result of the total displacement of the Current away from the coast, and Bang (1970) points out that such divergence is a fundamental characteristic of this essentially convergent zone.

The inshore current system off the Natal coast is characterized by periodic current reversals parallel to the coast at intervals of four to six days. These reversals appear to be linked with atmospheric low pressure areas moving up the coast, and the countercurrents are associated with eddy systems which carry quanta of cooler water north eastwards along the coast. There is no evidence for a continuous cool countercurrent inshore of the Agulhas Current in Natal coastal waters in winter. Though it was formerly believed that such a countercurrent might exist to the west of East London, data based on drift cards released along the eastern Cape coast recently suggest that large scale inshore current reversals occur at fairly short intervals (Baird, pers. comm.), and the concept of a countercurrent in this region may require revision.

### Coastal and bottom topography

The coastline to the west of Algoa Bay consists of a series of warm sheltered bays connected by stretches of open rocky shore. The depth of water in these bays is always less than 100 m, and less than 50 m over much of their area.

The coastline to the north east of Algoa Bay is open and almost devoid of sheltered bays (Fig. 1). Off the open coastline the 50 m isobath lies approximately 3–5 km offshore except on the Tugela Bank north of Durban, where water less than 50 m in depth extends up to 20 km offshore.

The continental shelf along the SE coast of southern Africa varies considerably in width, from approximately 240 km across the Agulhas Bank (at 21° E), and narrowing north-east of Algoa Bay to about 8–10 km in width between Port St. Johns and Durban. Between Durban and Cape St. Lucia the continental shelf widens again to about 40 km, formed by the submerged Tugela River delta. From Cape St. Lucia northwards the shelf is narrow again, and is less than 3 km in width at some points.

The continental margin north east of Algoa Bay has retained much of its original shape when it was formed as a result of transform faulting during the separation of Africa and the

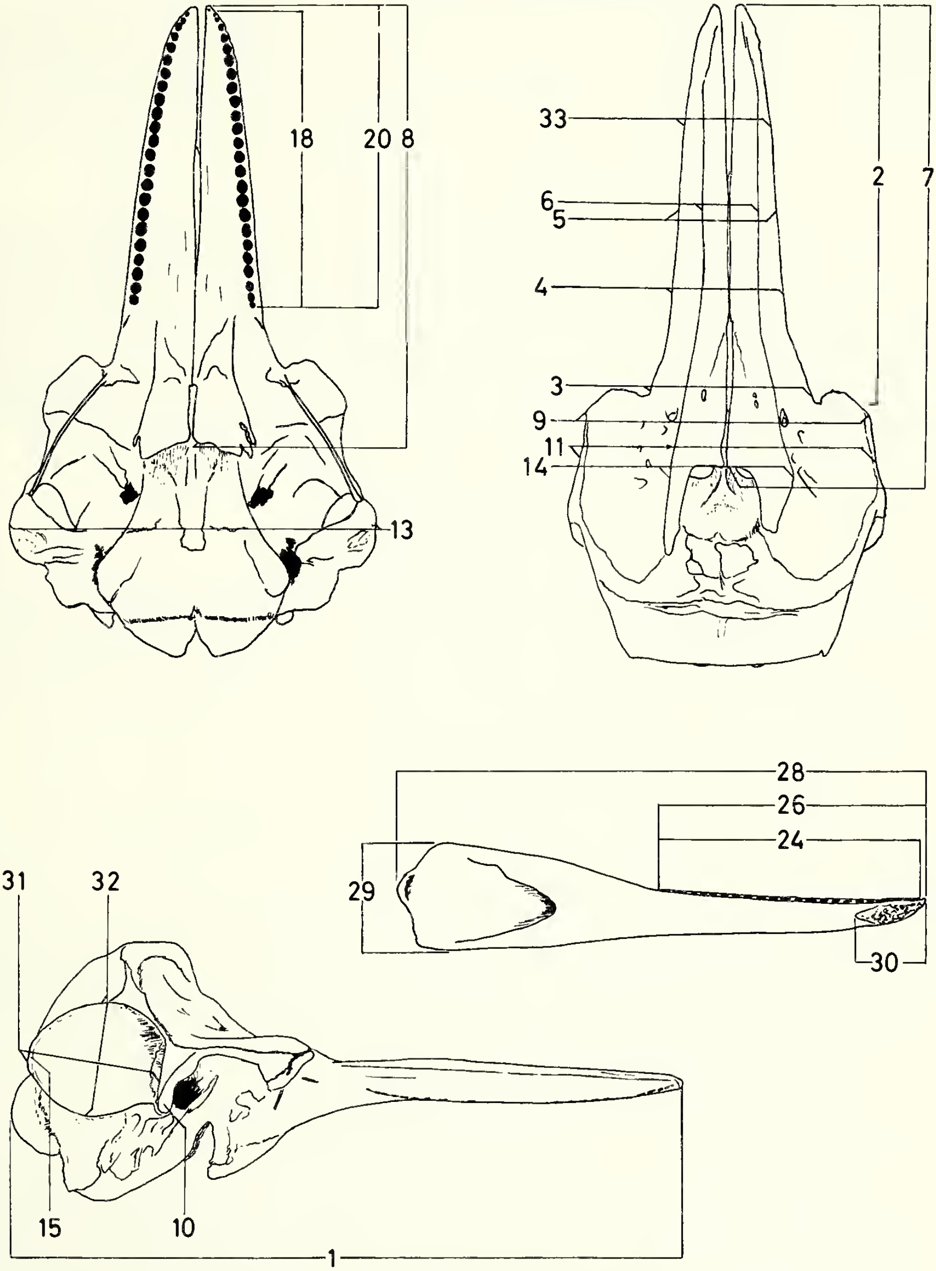


Fig. 4. Measurements taken of delphinid skulls for this study, as listed in Table 6.

Falkland Plateau during the breakup of Gondwanaland. Between Port St. Johns and Port Shepstone the continental slope is extremely steep with gradients of up to 12°, but north of Port Shepstone gradients decrease probably through the marginal influence of the Tugela River delta. Off Durban the slope is gentle and broad, formed from sediments spilt over the shelf break from the delta. West of Algoa Bay the continental slope becomes progressively more gradual as far as Cape Agulhas.

## TAXONOMY AND BIOLOGY

The supra-generic classification of the recent toothed whales, suborder Odontoceti, is not entirely settled. The classifications of Simpson (1945), Fraser and Purves (1960), Nishiwaki (1963, 1964), Hershkovitz (1966), Rice and Scheffer (1968) and Kasuya (1973) differ considerably in the ranking of genera in superfamilies, families and subfamilies. In this report the classification of Rice and Scheffer (1968) is followed, which divides the odontocetes into five families (Platanistidae, Ziphiidae, Physeteridae, Monodontidae, and Delphinidae). Representatives of three of these families have been recorded on the SE coast of southern Africa: Ziphiidae, 8 species; Physeteridae, 3 species, including the sperm whale *Physeter macrocephalus*; Delphinidae, 14 species.

### Family ZIPHIIDAE
### Beaked Whales

Small to medium sized whales (4,3–12,8 m in length for adults) in which the snout is narrow and protrudes forming a beak. On the throat there is a pair of grooves which converge anteriorly but are not joined. There is no median notch in the trailing edge of the caudal flukes. There are one or two pairs of teeth in each lower jaw of all but one species, and as a rule these erupt in adult males only.

The generic characters of the family have been reviewed by Moore (1968), whose arrangement is followed here.

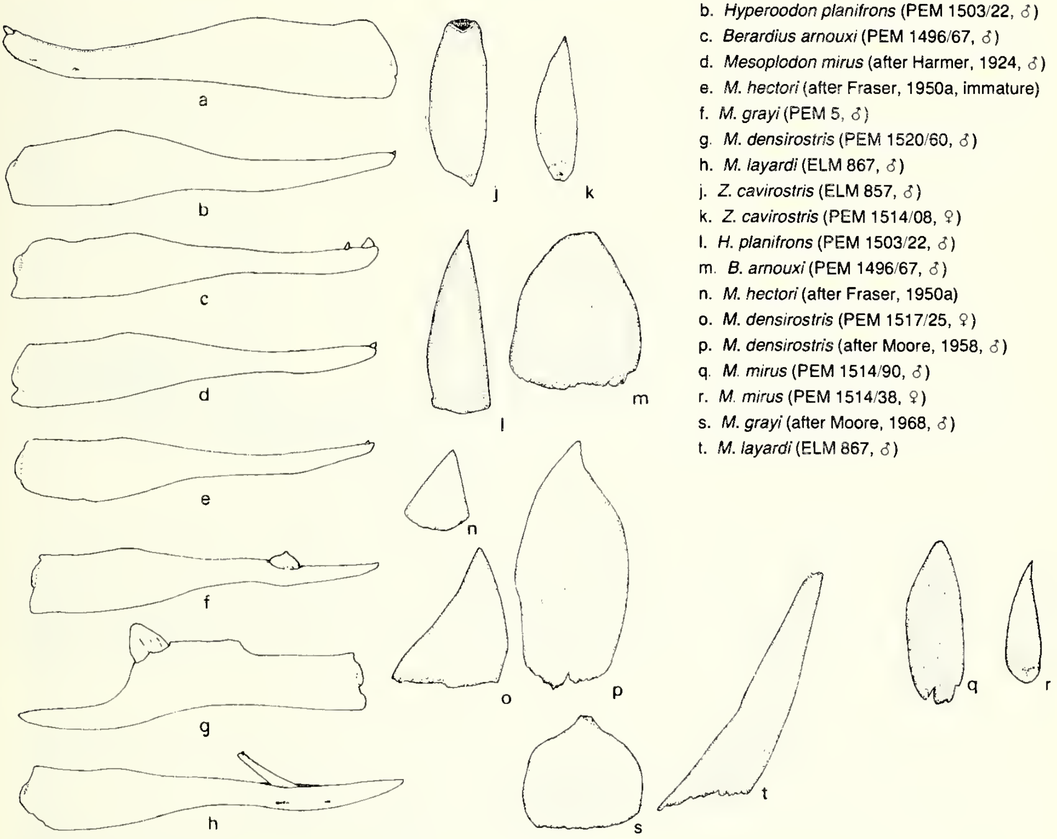
### Genus *MESOPLODON* Gervais, 1850

*Ann. Sci. Nat. Paris*, (3), *Zool.*, *14*: 16; type species *Delphinus sowerbiensis* Blainville, 1817; type locality La Havre, France.

Eleven species are currently recognized in this genus (Moore, 1968). Alveoli of adult males more than 30 mm deep; the teeth are compressed so that the greatest anteroposterior diameter is at least 1,66 times the greatest transverse width; the anterior faces of the premaxillary bones posterior to the superior nares are directed anterolaterally or anteriorly, but not anteromesially; the least distance between the pair of premaxillary foramina exceeds the greatest length of the larger maxillary foramen in the same individual.

Cranial characters distinguishing the six species known to Flower (1878) (*M. bidens, densirostris, europaeus, grayi, hectori* and *layardi*) were based on (a) the presence or absence of a deep longitudinal groove on the maxilla extending distally from the base of the rostrum (basirostral groove), (b) the anterior or posterior position of the premaxillary foramina relative to that of the maxillary foramina, (c) the presence or absence of rudimentary teeth in the upper jaw, (d) the position of the teeth in the mandible, and (e) the form of the teeth and their orientation in the mandible.

More recent revisions which include one or more of the remaining species (*M. bowdoini, carlhubbsi, ginkgodens, mirus* and *stejnegeri*) invalidate the use of character (b) owing to intraspecific variation (Moore, 1960; Ross, 1970), while rudimentary teeth (character c) are rarely observed unless they are searched for specifically in the intact animal. The most important dis-



a. *Ziphius cavirostris* (ELM 857, ♂)
b. *Hyperoodon planifrons* (PEM 1503/22, ♂)
c. *Berardius arnouxi* (PEM 1496/67, ♂)
d. *Mesoplodon mirus* (after Harmer, 1924, ♂)
e. *M. hectori* (after Fraser, 1950a, immature)
f. *M. grayi* (PEM 5, ♂)
g. *M. densirostris* (PEM 1520/60, ♂)
h. *M. layardi* (ELM 867, ♂)
j. *Z. cavirostris* (ELM 857, ♂)
k. *Z. cavirostris* (PEM 1514/08, ♀)
l. *H. planifrons* (PEM 1503/22, ♂)
m. *B. arnouxi* (PEM 1496/67, ♂)
n. *M. hectori* (after Fraser, 1950a)
o. *M. densirostris* (PEM 1517/25, ♀)
p. *M. densirostris* (after Moore, 1958, ♂)
q. *M. mirus* (PEM 1514/90, ♂)
r. *M. mirus* (PEM 1514/38, ♀)
s. *M. grayi* (after Moore, 1968, ♂)
t. *M. layardi* (ELM 867, ♂)

Fig. 5. Mandibles (a-h) and teeth (j-t) of southern African beaked whales.

tinguishing features are still characters (d) and (e) given above (see Moore, 1968). The mandibles and teeth of the five species of *Mesoplodon* recorded on the southern African coast are illustrated in Fig. 5. These species are *M. layardi* (Gray), *M. hectori* (Gray), *M. grayi* Haast, *M. densirostris* (Blainville) and *M. mirus* True.

## ***Mesoplodon layardi*** (Gray, 1865)
## Layard's Beaked Whale

*Ziphius layardii* Gray, 1865a: 358 (original description); 1865b: 524 (characters); 1866: 353 (characters).
*Dolichodon layardii* Gray, 1871: 101 (classification); 1873: 110 (characters).
*Mesoplodon layardi* Flower, 1878: 684 (synonyms); 1885a: 11 (type specimen); Turner, 1880: 2 (description, figs); Sclater, 1901: 193; Fitzsimons, 1920: 219 (description, fig. of skull); Ellerman, Morrison-Scott and Hayman, 1953: 328 (distribution); Best, 1971: 2 (identification).
*Mesoplodon layardii* Trimen, 1888: 353 (additional specimen).
*Mesoplodon layardii* Roberts, 1951: 223 (description); Barnard, 1954: 20 (new records).

TABLE 7:

Records of *Mesoplodon layardi* on the SE coast of South Africa.

| Catalogue Number | Sex | Total Length (mm) | CBL (mm) | Date | Locality | Comments |
|---|---|---|---|---|---|---|
| — | — | — | — | Pre-1888 | Knysna (?) | Pair of teeth 370 mm in length in SAM (Trimen, 1888) |
| PEM 4 | ♂ | 5 840 | 1 167 | 18.02.07 | Swartkops Beach | Entire skeleton (Fitzsimons, 1920) |
| SAM 22408 | ♀ | 6 120 | *c.*1 065 | 07.03.59 | Plettenberg Bay | Skull in SAM; photographs in PEM |
| — | — | — | — | 1960 | near Mossel Bay | Teeth and photographs in ELM (Courtenay-Latimer, 1960) |
| ELM 867 | ♂ | *c.*5 490 | — | 09.04.68 | Fish River Point | Damaged skull, mandibles and teeth in ELM |

### RECORDS AND MATERIAL

*M. layardi* has been recorded on five occasions on the SE coast of southern Africa (Table 7). Material available from these strandings included a damaged skull, a complete skull and a complete skeleton. Skeletal material from a further nine specimens stranded on the south western Cape coast, and one specimen stranded at Whangerei, New Zealand was also measured at the South African Museum. Colour slides of an adult male stranded at Pelican Point, Walvis Bay in 1969 were also examined.

### SPECIFIC STATUS AND CHARACTERS

The specific status of *M. layardi* has been well-established for many years since Flower (1878) synonymized the types of *M. longirostris* Krefft, 1873, *M. güntheri* Krefft, 1871, *Dolichodon transversii* Gray, 1874 and *M. floweri* Haast, 1876 with *M. layardi.*

Flower (1878) stated that the basirostral groove is slightly developed in *M. layardi*, representing an intermediate condition in the genus. In 12 crania examined in this study the basirostral groove was present in each case, but was variable in its depth and extent, particularly in its proximal portion.

The mandibular teeth of *M. layardi* are situated at the posterior end of the mandibular symphysis (Table 9, nos. 6, 7). The characteristic teeth are triangular, compressed laterally and oriented postero-dorsally in the mandible. The apex of the tooth is everted laterally, forming a small, distinct denticle which is diagnostic for this species. In adult females the apex of each tooth rises above the alveolus but does not erupt through the gum. In adult males the teeth form strap-like tusks curving postero-dorsally over the upper jaw, meeting in the mid-line anterior to the forehead or melon.

### DESCRIPTION

An adult male *M. layardi*, 5,28 m in length (SAM 35111) which stranded at Hout Bay, Western Cape is illustrated in Fig. 6 based on photographs (Ross, Best, Baker & Mead, in prep.) and proportional measurements supplied by Dr. P. Best (*in litt.*)

*M. layardi* is the largest species in this genus (Moore, 1968) attaining lengths of at least 6 m. The beak is long and slender. The line of the gape is relatively straight, though stepped dorsally at the level of the single mandibular tooth, and terminates slightly below the horizontal plane passing through the eye. The melon is distinct, bulbous and slopes steeply anteriorly to an indistinct apex. The flippers are small with a rounded apex. The dorsal fin is small, falcate and placed about two-thirds of body length from the snout. The flukes are broad and lack a caudal notch.

There are few published measurements of proportional body measurements of *M. layardi* available. Measurements of the 5,84 m adult male (PEM 4) expressed as percentages of body length are: apex of beak to eye, 16,5; length of flipper, 9,6; length of dorsal fin base, 5,7; height of dorsal fin, 4[illegible] width of flukes, 23,5. The length of the exposed portion of the teeth was 280 mm (Fitzsimons, 1920; Roberts, 1951).

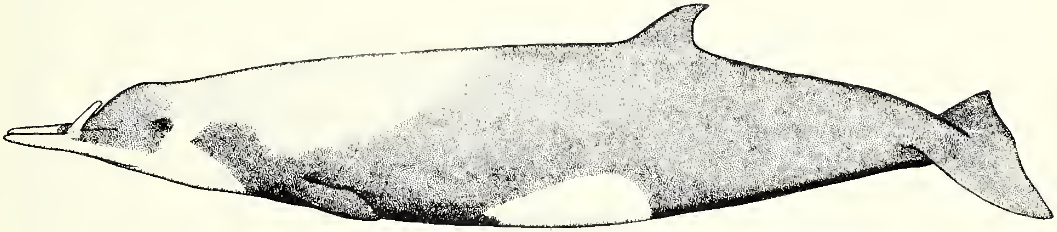


Fig. 6. Adult male *Mesoplodon layardi*, 5,28 m in length, from the south western Cape (SAM 35111).

In the adult male *M. layardi* illustrated in Fig. 6, the anterior portion of the beak, the throat, the band behind the eye and the genital region are white. The dorsal surface from the melon anterior to the blowhole to approximately mid-length of the whale is grey. The remainder of the body surface is black. This colour pattern has been recorded in adult males and females (Warneke, 1963; Ross *et al.*, in prep.)

The colour pattern of two fresh, immature *M. layardi* differed from that of adults, being dark grey or dark blue dorsally, lightening gradually on the side to a pale grey or pinkish colour ventrally. Ross *et al.* (in prep.) suggest that the colour pattern in this species changes with age, though it is not certain at which stage this occurs.

The cranial and post-cranial morphology of *M. layardi* has been described by Flower (1878) and in great detail, by Turner (1880). Measurements of the crania of 11 *M. layardi* are provided in Table 8 and those of the mandibles and teeth from 13 specimens in Table 9. With the exception of measurements of a small immature published by Turner (1880), those taken in the present study have only been compared with those published by Moore (1972) since the points of measurement are known to be the same (Ross, 1970).

Comparison of three females and five males in Table 8 and four females and six males in Table 9 indicates that there is little or no sexual dimorphism in the cranial or mandibular proportions of *M. layardi*, with the exception of those measurements associated with the alveoli or teeth (Table 9, nos. 8–13), and a tendency for a proportionately deeper rostrum at midlength in males (Table 8, no. 36).

There appear to be no differences in the cranial and mandibular proportions of the two Australian (Moore, 1972) and one New Zealand (SAM 35540) *M. layardi* compared to those of the southern African specimens in Tables 8 and 9 that might be indicative of different populations. However, the samples are extremely small, and such differences may be obscured by changes in proportions during growth.

The vertebral formula of PEM 4 is C7 T10 L12 Cd16 (+ 1?) = 46. The terminal caudal vertebra is missing. Turner (1880) records that the type of *M. floweri* (= *M. layardi*) had a ver-

TABLE 8:

Cranial measurements of *Mesoplodon layardi*. The condylobasal length (No. 1) is expressed in mm. All other measurements are expressed as percentages of condylobasal length. Measurement numbers are keyed to Table 3.

| Meas. | Falkland Islands, Turner, 1880 | SAM 35451 o ? | SAM 35449 ♀ | SAM 35450 ♀ | SAM 35452 ♂ | SAM 19931 o ? | AM 8229 ♂ Moore, 1972 | SAM 35111 ♂ | WAM 4564 ♂ Moore, 1972 | SAM 35540 ♀ | PEM 4 ♂ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 635 | 827 | 898 | 936 | 950 | 952 | 1 013 | 1 059 | 1 064 | (1 070) | 1 167 |
| 2 | 58,0 | 63,9 | 64,6 | 69,4 | 68,2 | 65,5 | 66,8 | 69,2 | 68,1 | 67,4 | 70,1 |
| 3 | 76,0 | 78,5 | 79,2 | 81,7 | 81,7 | 79,8 | — | 80,4 | — | 81,7 | 83,3 |
| 4 | — | 82,0 | 81,8 | 84,6 | 85,1 | 82,9 | 83,1 | 83,9 | 84,6 | 84,4 | 85,5 |
| 5 | — | 53,8 | 56,6 | 58,3 | 58,4 | 56,8 | 54,2 | 58,3 | 56,1 | 58,7 | 60,1 |
| 6 | — | 58,5 | 64,5 | 64,5 | 65,1 | 64,7 | 61,4 | 65,5 | 64,5 | 57,1 | 62,2 |
| 7 | — | 92,9 | 93,2 | 96,0 | 96,0 | 93,9 | 92,3 | 96,0 | 93,8 | 94,5 | 95,9 |
| 8 | — | 75,3 | 75,6 | 79,0 | 78,0 | 75,8 | 75,9 | 80,0 | 77,5 | 78,5 | 79,8 |
| 9 | — | 76,5 | 75,7 | 79,6 | 79,0 | 77,2 | 77,2 | 78,9 | 77,2 | 78,7 | 79,5 |
| 10 | — | 91,0 | 94,3 | 95,4 | 96,5 | 92,9 | 93,9 | 95,1 | 93,6 | 94,6 | 95,9 |
| 11 | — | 83,2 | 82,6 | 86,2 | 84,9 | 83,5 | — | 84,7 | — | 85,8 | 84,5 |
| 12 | — | 59,2 | 60,1 | 62,1 | 61,2 | 61,1 | 58,0 | 61,8 | 61,4 | 63,0 | 64,3 |
| 13 | — | (12,1) | 12,8 | 13,0 | (13,6) | 12,7 | 13,8 | 13,2 | 13,0 | 12,3 | 11,9 |
| 14 | — | 12,3 | 10,8 | 11,2 | 10,6 | 11,2 | 12,6 | 11,0 | 11,0 | 10,3 | 9,0 |
| 15 | — | 5,8 | 7,0 | 6,0 | 7,4 | 5,4 | 5,8 | 6,6 | 6,6 | 6,0 | 5,6 |
| 16 | — | — | — | — | — | — | 5,2 | — | 6,0 | — | — |
| 17 | — | 41,1 | 40,8 | 42,2 | 39,7 | 40,4 | 42,3 | 41,7 | 41,4 | 39,9 | 40,3 |
| 18 | 44,5 | 39,7 | 39,9 | 40,6 | 39,3 | 40,1 | 41,2 | 40,4 | 39,5 | 38,8 | 38,9 |
| 19 | 41,0 | 38,6 | 38,5 | 40,4 | 39,1 | 36,9 | 40,1 | 39,1 | 39,4 | 37,0 | 37,5 |
| 20 | — | 27,8 | 26,5 | 25,7 | 23,8 | 26,2 | 25,5 | 25,5 | 24,8 | 23,4 | 22,5 |
| 21 | 17,0 | 15,8 | 14,7 | 13,4 | 14,0 | 13,7 | 13,3 | 12,3 | 13,2 | 13,1 | 11,1 |
| 22 | — | 6,1 | 4,9 | 5,2 | 5,5 | 5,6 | 4,6 | 4,2 | 5,0 | 5,1 | 4,2 |
| 23 | — | 10,0 | 8,0 | 9,0 | 8,5 | 8,5 | 9,4 | 7,7 | 8,6 | 8,1 | 8,0 |
| 24 | — | 6,3 | 6,2 | 5,2 | 4,9 | 4,7 | 4,9 | 5,1 | 4,8 | 4,9 | 4,3 |
| 25 | — | 34,0 | 33,9 | 32,5 | 32,5 | 33,7 | 33,8 | 31,6 | 33,3 | 31,3 | 32,0 |
| 26 | — | 5,1 | 4,6 | 5,1 | 5,3 | 4,7 | 3,9 | 4,4 | 5,3 | (2,6) | 4,5 |
| 27 | — | 2,7 | 2,6 | 2,9 | 1,9 | 3,6 | — | 2,4 | — | 1,5 | 1,7 |
| 28 | — | 0,0 | 1,6 | 1,2 | 0,4 | 2,5 | 3,2 | 0,0 | 1,6 | 0,9 | 2,8 |
| 29 | 20,0 | 17,6 | 16,9 | 16,6 | 16,4 | 17,6 | 16,5 | 16,8 | 15,7 | 15,9 | 15,3 |
| 30 | 14,0 | 12,3 | 12,6 | 11,6 | 11,8 | 12,4 | 12,0 | 11,3 | 10,8 | 11,3 | 9,9 |
| 31 | 12,5 | 11,0 | 12,9 | 11,4 | 12,5 | 11,9 | 12,5 | 10,9 | 11,4 | 10,6 | 10,9 |
| 32 | — | 4,4 | 4,0 | 3,9 | 3,9 | 4,4 | 3,4 | 4,9 | 3,5 | 4,4 | 4,5 |
| 33 | 27,0 | 24,5 | 23,3 | 23,9 | (19,4) | 24,7 | 25,2 | 22,3 | 22,1 | 22,1 | 21,6 |
| 34 | — | 15,2 | 14,1 | 15,6 | 11,7 | 15,2 | 12,7 | 11,9 | 11,6 | 12,6 | 11,2 |
| 35 | 7,0 | 6,4 | 5,5 | 5,1 | 5,6 | 6,6 | 6,0 | 5,7 | 5,1 | 5,8 | 6,2 |
| 36 | — | 2,3 | 4,9 | 4,8 | 4,5 | 6,2 | 7,8 | 5,8 | 6,1 | 5,5 | 5,9 |
| 37 | 8,0 | 6,8 | 5,9 | (6,2) | (5,8) | 5,9 | 5,2 | 5,8 | 5,4 | (5,4) | 5,4 |
| 38 | — | 11,1 | 10,6 | 10,9 | 10,0 | 10,3 | 10,2 | 9,9 | 10,2 | 9,3 | 9,3 |
| 39 | 43,5 | (38,7) | 37,9 | 39,0 | (39,4) | 38,0 | — | 36,1 | — | 35,7 | 35,5 |
| 40 | — | (6,7) | (7,2) | (6,9) | (6,7) | 6,3 | 9,1 | (7,6) | 6,7 | (6,1) | 5,2 |
| 41 | — | 10,8 | 11,1 | 10,3 | 8,6 | 9,5 | 10,5 | 9,0 | 10,1 | 9,2 | 8,3 |
| 42 | — | 3,3 | 3,8 | 3,8 | 3,5 | 3,3 | 3,8 | 3,3 | 3,2 | 3,4 | 4,1 |
| 43 | — | (9,6) | 10,2 | 10,5 | 10,7 | 10,2 | 6,9 | 10,8 | 6,3 | 9,2 | 10,7 |
| 44 | — | 29,0 | 28,0 | 23,5 | 29,4 | 21,8 | 25,3 | 21,8 | 24,6 | 26,6 | 21,5 |
| 45 | — | — | — | — | — | — | — | — | — | 5,6 | — |

( ) denotes approximate measurement.

TABLE 9:

Mandibular measurements of *Mesoplodon layardi*. Mandibular length and those relating to the teeth and alveoli (numbers 1, 8, 9, 11–13) are in mm. Other measurements are expressed as percentages of mandibular length. Measurement numbers are keyed to Table 4.

| Meas. | Falkland Islands o ? Turner, 1880 | SAM 35451 o ? | SAM 35449 ♀ | SAM 19931 o ? | SAM 35452 ♂ | SAM 35450 ♀ | SAM 19932 o ? | AM 8229 ♂ Moore, 1972 | WAM 4564 ♂ Moore, 1972 | SAM 35111 ♂ | SAM 22408 ♀ | PEM 4 ♂ | SAM 35540 ♀ | ELM 867 ♂ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 450 | 723 | 760 | 810 | 819 | 842 | 854 | 870 | 880 | 924 | 966 | 1 008 | — | 1 015 |
| 2 | 26,1 | 26,1 | 29,6 | 27,9 | 32,6 | 33,6 | 30,9 | 32,1 | 31,5 | 29,8 | 37,3 | 30,9 | — | 30,2 |
| 3 | — | 15,2 | 15,8 | 15,6 | 14,0 | 13,9 | 14,1 | 14,8 | — | 15,4 | 13,4 | 13,7 | — | 14,0 |
| 4 | — | 6,5 | 5,5 | 5,4 | 5,5 | 5,5 | 6,3 | 5,7 | 6,3 | 4,9 | 5,7 | — | — | 5,6 |
| 5 | — | 6,8 | 6,1 | 6,0 | 6,3 | 5,9 | 6,9 | 7,4 | 6,9 | 6,5 | 6,0 | — | — | 6,9 |
| 6 | — | 73,9 | 70,4 | 72,1 | 67,4 | 66,4 | 69,7 | 68,4 | 69,5 | 70,3 | 62,7 | 68,9 | — | 60,1 |
| 7 | — | 72,6 | 72,5 | 71,5 | 68,7 | 68,3 | 68,7 | 60,6 | 61,9 | 61,8 | 65,0 | (62,9) | — | 55,9 |
| 8 | — | (65) | (56) | 55 | (68) | (62) | 72 | 120 | 139 | (115) | (75) | (140) | — | 134 |
| 9 | — | 11 | 8 | 10 | 14 | 16 | 17 | 17 | 16 | 8 | 16 | — | — | 16 |
| 10 | — | 18,1 | 20,3 | 21,0 | 23,2 | 24,0 | 22,6 | — | 23,2 | 26,7 | 26,4 | (23,3) | — | 20,7 |
| 11L | 51** | 57 | 50 | 65 | 84 | 72 | 88 | — | — | 333 | 131 | 334* | 108 | 312 |
| 11R | — | 57 | 46 | 64 | 84 | 73 | 86 | — | — | 317 | 128 | 324* | 108 | — |
| 12L | 20** | (25) | 26 | 31 | 33 | 30 | 38 | — | — | 55 | 40 | 58 | 38 | 55 |
| 12R | — | (25) | 26 | 35 | 32 | 31 | 38 | — | — | 56 | 40 | 58 | 38 | 54 |
| 13L | — | (8) | 7 | 7 | 8 | 7 | 9 | — | — | 11 | 11,5 | 13 | 8 | 13 |
| 13R | — | (8) | 7 | 7 | 7 | 7 | 9 | — | — | 11 | 12 | 14 | 8 | 12 |

( ) denotes approximate measurement.
* includes an estimated 25 mm embedded in the alveolus.
** side uncertain.

tebral formula of C7 T10 L10 Cd19 = 46, while that of a young specimen from East Falkland Island was C7 T9 L10 Cd18 = 44, but suggested that two of the terminal vertebrae of the latter specimen had not ossified. The length of the mounted skeleton of PEM 4 is 5,74 m, including material simulating the intervertebral cartilage. The epiphyses of all vertebral centra are fused to their respective centra, indicating attainment of physical maturity.

### Biology

*Growth and development:* The length at birth of *M. layardi* is not known, but by analogy with the lengths at birth and maximum lengths attained by females of two other species of beaked whales, *Hyperoodon ampullatus* (Benjaminsen, 1972) and *Berardius bairdi* (Nishiwaki and Oguro, 1971), in which the length at birth is approximately 40% of the lengths attained by the largest females, the length at birth of *M. layardi* is probably about 2,2–2,4 m.

Data on the maximum length attained by *M. layardi* are limited. Measurements of five adult males and five adult females are given in Table 10. The specimen described by Praderi (1972) has been included as a female on the basis of the tooth length (109 mm), which is close to that of two known females given in Table 9. The limited evidence suggests that adult females may attain a slightly greater size than adult males. However, much larger samples will be required before this dimorphism can be confirmed.

*Reproduction:* Very little is known concerning reproduction in *M. layardi*. McCann (1964a) described the reproductive organs of a stranded female. Two pregnant females have been recorded from New Zealand, one with a small foetus in June and the second with a 0,76 m long foetus in July (Gaskin, 1968a). The gestation period of *M. layardi* is unknown but, if it is approximately one year as in many other cetaceans and if the length at birth is approximately 2,2–2,4 m, the size of the recorded foetus suggests that conception occurred in the first months of the year.

The smallest calf on record (2,8 m in length, SAM 35541), stranded with a lactating female (SAM 35540) at Whangerei, New Zealand in April 1966, has been reported by Ross *et al.* (in prep.) who also give some details of an analysis of the milk from the adult. The length of this calf compared to the suggested length at birth indicates that it was only a few months old and was probably born earlier in the same year.

*Food and Feeding:* There appears to be no published record of the food of this species based on examination of stomach contents. Sclater (1901) records that the food of *M. layardi* consists of cephalopods, but this observation is probably based on the assumption by Trimen (1888) that *M. layardi* is similar in habits to other beaked whales known to eat cephalopods. Both of these authors commented on the ability of the adult male to open the mouth fully and to swallow food other than soft-bodied animals such as cephalopods. Fitz Simons (1920), however, found that the tips of the jaws of PEM 4 could only be opened 11–13 cm before the upper jaw was restricted by the mandibular teeth.

### Distribution and migration

*M. layardi* has a circumpolar distribution in the southern hemisphere. That the majority of southern African strandings have occurred on the SW Cape coast and that relatively few strandings have occurred east of Cape Agulhas suggest that the SE coast is at the limit of distribution. Two specimens are known from Walvis Bay, South West Africa (Turner, 1980; Barnard, 1954).

Elsewhere strandings are recorded from New Zealand (Gaskin, 1968, Robson and van Bree, 1977), Tasmania (Guiler, 1967), Western Australia (Moore, 1972), South Australia (Aitken, 1971), Victoria (Warneke, 1963), New South Wales (Marlow, 1963), Queensland (Longman, 1926), The Falkland Islands (Turner, 1880) and Uruguay (Praderi, 1972). The northernmost stranding records are for Walvis Bay (23° S) and Rockhampton (23° S) and Southport

TABLE 10:

Maximum lengths recorded for five male and five female *Mesoplodon layardi*

| Catalogue Number | Locality | Sex | Length (m) | Source |
|---|---|---|---|---|
| — | Cape Point, Cape Province | ♂ | c.5,5 | Sclater, 1901 |
| M 794 | Kangaroo Island South Australia | ♂ | 5,56 | Waite, 1922 |
| PEM 4 | Swartkops River Mouth, Eastern Cape Province | ♂ | 5,84* | Present study |
| SAM 35111 | Hout Bay, Western Cape Province | ♂ | 5,28* | Ross *et al.*, in prep. |
| ELM 867 | Fish River Mouth, Eastern Cape Province | ♂ | c.5,5 | Present study |
| SAM 22408 | Plettenberg Bay, Eastern Cape Province | ♀ | 6,12 | Present study |
| SAM 35540 | Whangerei, New Zealand | ♀ | 6,15 | Ross *et al.*, in prep. |
| SAM 35548 | Bakoven, Western Cape Province | ♀ | 5,63* | Ross *et al.*, in prep. |
| MNHN 2471 | Isla de la Tuna, Uruguay | ♀ | 6,08 | Praderi, 1972 |
| — | Napier, New Zealand | ♀ | 5,54 | Robson and van Bree, 1972 |

* Known to be physically mature.

(28° S) in Queensland (Longman, 1926). The southernmost record is for the Falkland Islands (52° S) (Turner, 1880). The majority of records lies between latitudes 33° S and 43° S.

In Table 11 the seasonal occurrence of dated records is compared to latitude. South of latitude 38° S the records are distributed throughout the year. North of 38° S the records are distinctly seasonal, occurring in the summer months from December to April, with the single exception of the Western Australian record. The seasonal pattern suggests that *M. layardi* tends to move northwards in the summer months. The purpose of such a movement is not known. Records north of latitude 38° S include juvenile and adult animals of both sexes (Hale, 1931; Aitken, 1971; Ross *et al.*, in prep.). Though the data on mating and calving times are very limited, they appear to coincide with the more northerly distribution of *M. layardi* in summer

## ***Mesoplodon hectori*** (Gray, 1871)
## Hector's Beaked Whale

*Berardius hectori* Gray 1871: 117 (holotype, skull, BM 1677b.76.2.16.3; type locality, Titahi Bay, Cook Strait, New Zealand).

*Mesoplodon hectori* Flower 1878: 416 (skull description, taxonomy); Ross, 1970: 195 (new records); Best, 1971:2.

### RECORDS AND MATERIAL

The crania and mandibles of two immature specimens (PEM 1511/15, 1511/16) stranded at Lottering River Mouth (34° 00′S, 23° 45′E) were collected in March 1967. These specimens are the fifth and sixth known specimens of this species.

### SPECIFIC STATUS AND CHARACTERS

Five of the six known specimens of *M. hectori* are immature animals (CBL 505–601mm) and the sixth animal, purported to be an adult, is only slightly longer than the others (CBL 667 mm) (Moore, 1972). The immaturity of the four specimens of *M. hectori* then known and the apparent absence of juvenile specimens of *Berardius arnouxi* Duvernoy led McCann (1962) to place *M. hectori* as a junior synonym of *B. arnouxi*, basing his conclusions on a number of apparent similarities in cranial morphology.

TABLE 11:

Records of *Mesoplodon layardi* in relation to latitude and month

| | July | August | September | October | November | December | January | February | March | April | May | June |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SOUTH AFRICA | | | | | | | | | | | | |
| 23° | | | | | | | | | | 1 | | |
| 33°–35°S | | | | | | | 1 | 2 | 1 | 3 | | |
| WESTERN AUSTRALIA | | | | | | | | | | | | |
| 32°S | 1 | | | | | | | | | | | |
| URUGUAY | | | | | | | | | | | | |
| 34°S | | | | | | | | 1 | | | | |
| NEW SOUTH WALES | | | | | | | | | | | | |
| 34°S | | | | | | | | | | 1 | | |
| SOUTH AUSTRALIA | | | | | | | | | | | | |
| 35°–36°S | | | | | | 1 | 3 | 4 | 2 | | | |
| VICTORIA | | | | | | | | | | | | |
| 38°S | | | | | | | | | | | | 1 |
| NEW ZEALAND | | | | | | | | | | | | |
| 35°S | | | | | | | | | | 1 | | |
| 39°S–43°S | 1 | | | 1 | | | 2 | 2 | 3 | | | 1 |
| TASMANIA* | | | | | | | | | | | | |
| 40°–43°S | | | | | | | | 1 | | | | |

* Guiler (1967) records two strandings in the winter months.

Moore (1968) presented evidence refuting McCann's (1962) conclusions and re-instated *hectori* in the genus *Mesoplodon*. McCann (1962) held that the dorsal cranial bones of *M. hectori* were almost bilaterally symmetrical, thus resembling the condition found in *Berardius*. Moore (1968) and Ness (1967; *in litt.*), however, have shown that the asymmetry of *M. hectori* is comparable to that of *M. bidens, densirostris, europaeus, grayi* and *mirus*.

The presence of a blind pit on the posterior wall of the superior nares in *M. hectori* and *Berardius* was considered to be an important taxonomic feature by McCann (1962, 1975). However, this pit is also present in *M. densirostris, grayi, layardi* and possibly *mirus* and, though no longer of generic importance, variations in the shape of the pit may prove useful as a specific character (Ross, 1970).

McCann (1975) gives measurements indicating that *B. arnouxi* attains lengths of 8,5–9,3 m and suggests that neonatals do not exceed 3 m in length, but that the records (i.e. those of *M. hectori*) could be of animals prematurely born when the true neonatal length would be slightly greater. McCann's proposed birth length of 3 m is probably a slight underestimate by comparison with the birth length (4,5 m) of the larger species *B. bairdi* (Nishiwaki and Oguro, 1971). McCann's contention that all *M. hectori* are actually juvenile *B. arnouxi* implies that all known specimens of *M. hectori*, including the longest specimen recorded (*c.* 3,7 m in length; Guiler, 1967), were born prematurely or were neonatal animals. Inspection of the two South African specimens, however, indicates that they are older than neonates, judging by the degree of fusion and cohesion of the cranial elements compared to crania of a near-term foetal *M. densirostris* and a neonatal *M. mirus* which required reassembling after cleaning and preparation.

Kasuya (1973) has shown that there is a slight increase in the length of the tympanic bulla with an increase in body length in *Globicephala macrorhynchus* and *Neophocaena phocoenoides* and no increase with age in the length of the bulla in *Tursiops truncatus*. A slight increase in the length of the bulla of *M. densirostris* with age is apparent in measurements provided in the present study (Table 25). These results imply that tympanic bulla length in juveniles and adults of other species is likely to be very similar. The lengths of the tympanic bullae in two specimens of *B. arnouxi* are 73 mm and 80 mm (McCann, 1975) and 63,2 mm (Kasuya, 1973). Tympanic bullae lengths in four specimens of *M. hectori* are 54 mm, 51 mm, and 51,5 mm (McCann, 1975) and 49 mm (PEM 1511/15, present study). The disparity in these two groups of measurements is greater than intraspecific variation recorded in the species studied by Kasuya (1973), including seven species of Ziphiids for which samples of two or more specimens were available, and indicates that specimens of *M. hectori* can not be considered as juveniles of *B. arnouxi*.

The only tympanic bulla of *M. hectori* (PEM 1511/15) available to the author closely resembles the bullae of six species of *Mesoplodon*, described and figured by Kasuya (1973), and presents the truncated posterior processes, the deep interprominential notch and flattened bulla which in combination distinguish *Mesoplodon* species from those of *Ziphius, Hyperoodon* and *Berardius*. In ventral view the shape of the bulla is similar to that of *M. gingkodens* (Fig. 29) particularly in the form of the inner posterior process. The rugose area on the ventral surface is similar in shape and extent to that of *M. stejnegeri* and the position and curvature of the ventral keel resembles that of *M. europaeus*. The close resemblance of the tympanic bullae of *M. hectori* and *M. grayi* has been pointed out by Flower (1878). Comparison of these two species in Fig. 29 shows the similarity clearly and the only difference apparent in this view is the greater development of the outer posterior prominence in *M. grayi*.

There seems little doubt that *M. hectori* has a closer affinity with the genus *Mesoplodon* than with *Berardius* and that Moore's (1968) inclusion of *M. hectori* in *Mesoplodon* was correct. The two South African specimens of *M. hectori* conform on all six of the nine characteristics of the genus *Mesoplodon* given by Moore (1968) that are not restricted to adult specimens (Ross, 1970).

Crania of *M. hectori* may be distinguished from the other ten species in the genus by the relatively narrow width of the premaxillary crests, which is equal to or slightly less than that across the premaxillaries at the level of the anterior border of the superior nares (Ross, 1970).

A lateral basirostral groove is absent in this species and the position of the premaxillary foramina in relation to the maxillary foramina is variable. The mesorostral canal is open in both South African specimens.

The position of the single mandibular tooth is characteristic for the species (Fig. 5) and is situated a few millimetres from the anterior tip of the mandible. The tips of the mandibles of PEM 1511/15 were broken off. This distance is 25 mm (5,2% of mandible length) in the type specimen, 11,5 mm (2,3% of mandible length) in the Falkland Island specimen, and 17 mm in the specimen from Tasmania (Guiler, 1967). The tooth is triangular (in these immature animals) and oriented slightly anteriorly.

### DESCRIPTION

The external morphology and colour pattern of this species are not known. The longest specimen recorded was approximately 3,66 m (12 feet) in length (Guiler, 1967). The flukes of PEM 1511/15 have been figured by Ross (1970).

The cranial and mandibular appearance of *M. hectori* has been described and figured by Flower (1878), Fraser (1950a), McCann (1962) and Ross (1970). Cranial measurements of available material are given by Ross (1970) and Moore (1972).

### BIOLOGY

No data.

### DISTRIBUTION AND MIGRATION

The six specimens presently known are recorded from New Zealand (2), the Falkland Islands (1), Tasmania (1) and South Africa (2). The species appears to have a circumpolar distribution in the Southern Ocean (Fraser, 1950a; Ross, 1970) but the latitudinal limits of distribution are unknown.

The two New Zealand specimens stranded in January (McCann, 1962) and the Tasmanian animal in March (Guiler, 1967). The month of stranding of the Falkland Island specimen is unknown. The two South African skulls with dried flesh adhering to them and associated with the dried flukes and decomposed flipper of one animal were collected in March suggesting that the stranding may have occurred two or three months earlier. These known or inferred stranding dates are all in the summer months, possibly indicating seasonal onshore or migratory movement in this species.

## ***Mesoplodon grayi*** Haast, 1876
## Gray's Beaked Whale

*Berardius hectori* Hector (not Gray), 1874: 86 (mandible and tooth).

*Mesoplodon grayi* Haast 1876: 9 (syntypes, three skulls, Canterbury Museum, Christchurch, New Zealand; type locality, Chatham Island, New Zealand); Flower, 1878: 417 (osteology); Lydekker, 1911: 420 (first South African record); Ellerman, Morrison-Scott and Hayman, 1953: 328; Barnard, 1954: 19 (records); Courtenay-Latimer, 1963: 122 (new record); Best, 1971: 2 (identification).

*Mesoplodon bidens* FitzSimons (not Sowerby), 1920: 221 (misidentification).

*Mesoplodon densirostris* Roberts (part, not Blainville), 1951: 223 (misidentification).

### RECORDS AND MATERIAL

There are three records of *M. grayi* on the SE coast of Southern Africa, and details of these strandings are given in Table 12. Only material from the Cape Receife specimen was examined in this study.

Table 12:

Records and material of *Mesoplodon grayi* on the SE coast of southern Africa.

| Catalogue Number | Sex | Total Length (mm) | CBL (mm) | Date | Locality | Comments |
|---|---|---|---|---|---|---|
| PEM 5 | ♂ | 4 720 | — | 27.04.10 | Cape Receife, Eastern Cape Province | Physically mature.<br>Entire skeleton pres.<br>Teeth missing. |
| SAM 19470 | — | — | — | pre-1948 | Mossel Bay | Skull only. Barnard (1954). |
| — | ♂* | 5 640 | — | 09.01.63 | Igulu Beach | Courtenay–Latimer (1963). |

* Sexed as a male on the basis of erupted teeth.

## Specific status and characters

Flower (1878) described the skeletal morphology of *M. grayi* in detail, comparing this species with material from *M. australis* Flower, *M. haasti* Flower and five other species of *Mesoplodon* then recognized. Flower noted that the specific status of *M. grayi* was well established but that the status of *M. australis*, in which the mandibular teeth of the one known specimen were missing, and that of *M. haasti*, known only from a rostrum and mandible, was uncertain. Forbes (1893) synonymized *M. australis* and *M. haasti* with *M. grayi* after examining further material.

The cranial rostrum of *M. grayi* is slender, elongate, narrow at its base and in profile its dorsal margin is straight. There are no prominential notches (in dorsal view, where the maxillaries widen at the base of the rostrum). The presence of 15–22 (usually 17–19) small teeth (Boschma, 1950; Robson, 1975) set in the well-defined basirostral groove of the rostrum appears to be characteristic of this species. These teeth are evenly spread over some 10 cm posterior to the level of the single mandibular tooth and may protrude 2–3 mm above the surface of the gum. Boschma (1950) points out that the presence of open roots on the teeth of the specimen figured by Haast (1876) suggests that these teeth were actively growing and hence were probably functional rather than rudimentary in nature.

The midpoint of the length of the alveolus lies approximately on the same transverse plane as the posterior end of the symphysis (Fig. 5). The mandibular tooth is oriented vertically in the alveolus at all ages (Moore, 1968). It is compressed laterally, is squarish basally in profile and only protrudes through the gum a few millimetres in adult males.

## Description

An adult female, 4,6 m in length, is illustrated in Fig. 7 (after Boschma, 1951). The body is elongate and, to some degree, compressed laterally. The melon bulges dorsally anterior to the blowhole, then slopes anteriorly to merge smoothly into the long, slender beak. The dorsal fin is small, and set about two-thirds body length from the tip of the beak. The flippers are small and relatively broad. The flukes lack a caudal notch.

Expressed as percentages of body length, the external measurements of the 4,72 m adult male stranded at Cape Receife (PEM 5) are: tip of upper jaw to eye, 14,5; length of gape, 8,6; anterior of fin to posterior of flukes, 42,5; length of flipper, anterior insertion to tip, 10,8; length of flipper, axilla to tip, 8,6; dorsal fin height, 4,3; width of flukes, 28,0; projection of lower jaw beyond upper, 0,54 (FitzSimons, 1920). The blubber was 51 mm thick dorsally, and

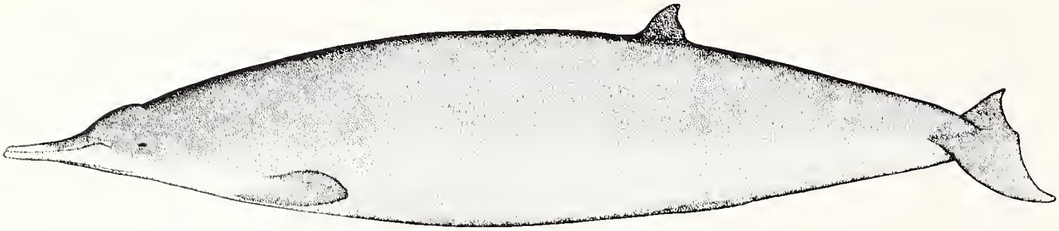


Fig. 7. Adult female *Mesoplodon grayi*, 4,60 m in length, from Holland (after Boschma, 1951).

38 mm thick laterally and ventrally. Courtenay-Latimer (1963) recorded the width of the flukes of the 5,64 m Gulu Beach "male" as 1,07 m (18,9% body length). A few external measurements have been provided by Glauert (1947) and Guiler (1969) for specimens stranded in Victoria and Tasmania respectively.

Boschma (1951) described the colour pattern of the adult female stranded on the coast of Holland. The dorsal surface was black to slate grey, gradually becoming brownish grey on the sides. The ventral surface was light grey with a brownish tinge, darkening slightly in the midline posterior to the flippers. The edges of the upper jaw, the lower jaw, throat, and around the umbilicus and genital area were whitish in colour. Baker (1972) also refers to the whitish colour of the beak in *M. grayi*. Haast (1876) described New Zealand specimens as black dorsally, and reddish brown ventrally. Specimen PEM 5 was entirely jet black in colour but the description of the skin as being as "thin as paper" and the appearance of the animal in a photograph (FitzSimons, 1920) indicate that this animal was not freshly dead when examined and that post-mortem darkening of the pigment had probably occurred.

Cranial and mandibular measurements of PEM 5 are provided in Tables 31 and 32 respectively. The teeth of PEM 5 were 70 mm in length (this measurement is actually the height of the tooth but is comparable to the tooth length in other ziphiid whales). By comparison the tooth lengths of three adult males were 70 mm, worn distally (Glauert, 1947), 83 mm (Moore, 1968) and 84 mm (Flower, 1878). The typical form of these teeth is illustrated in Fig. 5.

The vertebral formula of PEM 5 is C7 T11 L12 Cd16+ = 46+. It appears from the comparison with other *Mesoplodon* skeletons in the PEM collection that three terminal caudal vertebrae are missing from the skeleton of PEM 5 which should therefore have a total of 49 vertebrae. Oliver (1922) gives the vertebral formula of four New Zealand specimens as:

C7 D11 L10 Cd20 = 48; C7 D10 L11 Cd19 = 47; C7 D9 L11 Cd20 = 47; C7 D10 L11 Cd20 = 48.

Flower (1878) comments that there is probably one terminal vertebra missing from the last two of these skeletons (the types of *M. grayi* and *M. australis*). The vertebral formula of a specimen stranded in South Australia was C7 T9 L11 Cd20 = 47.

## BIOLOGY

*Growth and development:* There are no data for the length at birth or subsequent growth patterns. Despite the number of known strandings there are few body lengths of this species on record. The lengths of four adult females were 5,33 m (Haast, 1876), 4,60 m (Boschma, 1951), 4,98 m (Robson and van Bree, 1972) and 4,94 m (Gambell *et al.*, 1975). The lengths of four adult males were 4,72 m (PEM 5, physically mature) (present study), 4,27 m (presumed to be adult on the extent of the mesorostral ossification) (Glauert, 1947), 5,64 m (Courtenay-Latimer, 1963) and 4,53 m (Guiler, 1969). The type of *M. australis* of sex unknown was 4,72 m in length. This specimen was also considered adult on the basis of the extensive mesorostral ossi-

Table 13:

Records of *Mesoplodon grayi* in relation to month and latitude*

| | July | August | September | October | November | December | January | February | March | April | May | June |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 31°S, 47°E | | | | | | | 1 | | | | | |
| SOUTH AFRICA<br>33°–34°S | | | | | | | 1 | | | 1 | | |
| SOUTH AUSTRALIA<br>35°–36°S | | | | | | | 1 | 1** | | 1 | | |
| WESTERN AUSTRALIA<br>33°S | | | | | | | | | | | | 1 |
| NEW ZEALAND<br>39°–43°S | | 1 | 1 | | 4 | | 1 | 3 | | 1 | | |
| TASMANIA<br>43°S | | | | | | | 1 | | | 1 | | |

* Gambell *et al.* (1975) record three sightings of *M. grayi* in January at 33°S, between 61° and 65°E.

** Aitken (1971) gives February as the month of stranding. However, Hale (1932), referring to the same specimen, states that the decomposing carcass was found in May.

fication (Flower, 1878). In contrast to the statement by Gaskin (1972) that adult males attain lengths of *c.* 5,5 m and adult females are *c.* 0,6 m shorter than males in length there is no indication in these small samples that *M. grayi* is sexually dimorphic in body length.

The mass of the adult female recorded by Gambell *et al.* (1975) was 999,5 kg when weighed in pieces, excluding and allowance for loss of body fluids during dissection.

*Reproduction:* No data.

*Food and feeding:* No data.

*School size: M. grayi* appears to form small schools. Though most strandings involve single animals, a school of 25 *M. grayi* stranded on the Chatham Islands in 1875 (Haast, 1876) and three animals stranded together in New Zealand in 1876 (Gaskin, 1968a). The specimen collected by Gambell *et al.* (1975) was in a school of five animals. These authors record three further sightings of *M. grayi* of which two were groups of five and six animals, and one was of a single animal.

Robson (1975) recorded three immature *M. grayi* (total lengths 3,75 m male, 3,99 m male, 3,73 m female) which stranded over two days at Napier, New Zealand. Though the strandings did not occur simultaneously, their close occurence in time and space suggests that the animals were associated prior to stranding. They have been considered as a single record for purposes of seasonal comparisons (Table 13).

### Distribution and migration

*M. grayi* has a circumpolar distribution in the southern hemisphere between 30° S and 45° S. Strandings or specimens have been reported from New Zealand and the Chatham Islands (27 strandings; Gaskin, 1968a; Robson and van Bree, 1972; Robson, 1975), Tasmania (two strandings; Guiler, 1969), South Australia (three strandings; Aitken, 1971), Victoria (one stranding; Brazenor, 1933), New South Wales (Ogilby, 1892), Western Australia (one stranding; Glauert, 1947), Argentina (one stranding; Praderi, 1972), South Africa (four strandings; Barnard, 1954; present study) and the South Western Indian Ocean at 31° 08′S, 47° 28′E (one specimen; Gambell *et al.*, 1975).

A unique record of this species in the northern hemisphere was reported by Boschma (1950), when a beaked whale stranded on the Dutch coast in 1927 was identified as *M. grayi.* It is uncertain whether this specimen represents an unkown North Atlantic population of *M. grayi* or was a vagrant from a southern hemisphere population.

The distribution by latitude and month of 20 dated records provided by the authors quoted above are presented in Table. 13.

With the exception of three records for the months of June, September and October, the majority of records (85%) occurs between the months of December and April, suggesting that this species may move onshore in summer and autumn.

## ***Mesoplodon mirus*** True, 1913
## True's Beaked Whale

*Mesoplodon mirum* True 1913: 1 (holotype, skull, partial skeleton, external cast, USNM 175019; type locality, Beaufort Harbour, North Carolina).

*Mesoplodon mirus* Talbot 1960a: 31, 1960b: 406 (first southern hemisphere record); McCann and Talbot, 1963: 137; Ross, 1969: 585 (new records); Best, 1971: 2 (identification).

### Records and material

Details of six South African specimens of *M. mirus* are provided in Table 14. Cranial material from these six specimens was available for study. Photographs of the only known Western Australian specimen of *M. mirus* were kindly provided by Mr J. Bannister, Western Australian Museum, Perth.

TABLE 14:

Records of *Mesoplodon mirus* on the SE coast of southern Africa.

| Catalogue Number | Sex | Total Length (mm) | CBL (mm) | Date | Locality | Comments |
|---|---|---|---|---|---|---|
| SAM 33295 | ♂ | 5 335 | *c.*783 | 21.05.59 | Wilderness | Skull cut in two (McCann and Talbot, 1963). |
| PEM 1514/38 | ♀ | 4 850 | 768 | 06.01.69 | Maitland River Mouth. Eastern Cape Province. | Pregnant, lactating, accompanied by PEM 1514/39 (Ross, 1969). |
| PEM 1514/39 | ♂* | 3 400 | — | 06.01.69 | Maitland River Mouth. Eastern Cape Province. | Stranded with PEM 1514/38. |
| PEM 1514/90 | ♂ | 4 650 | 808 | 01.07.69 | Jeffreys Bay | |
| PEM 1516/45 | ♀ | 5 100 | 839 | 05.03.71 | Plettenberg Bay | Lactating, accompanied by PEM 1516/46. |
| PEM 1516/46 | ♂ | 2 325 | — | 05.03.71 | Plettenberg Bay | Stranded with PEM 1516/45. |

* Originally sexed as a female in error (Ross, 1969).

### SPECIFIC STATUS AND CHARACTERS

*M. mirus* may be distinguished from all other species of *Mesoplodon* by the position of the single mandibular tooth, which is embedded in a deep alveolus at the apex of the mandible, though two pairs of teeth have been recorded in one specimen (Fraser, 1946). *M. mirus* can also be identified on cranial characters which have been used to distinguish this species from *M. europeaus* (Fraser, 1955; Moore and Wood, 1957; Moore, 1960) and four other species of *Mesoplodon* recorded on the North American coast (Moore, 1966).

The presence of a southern breeding population of *M. mirus* in the southern hemisphere is now firmly established (Talbot, 1960b; Ross, 1969), with sufficient material to examine Talbot's (1960a) suggestion that the two populations might be morphologically distinct. The following analysis of morphological variation in the two populations has been taken from an unpublished manuscript prepared jointly by the author and Dr J. C. Moore, and is presented here with grateful acknowledgement to Dr Moore for his contribution of data on nine northern hemisphere specimens (Table 15).

TABLE 15:

Details of specimens of *Mesoplodon mirus* from the North Atlantic examined by Dr. J. C. Moore for comparison with southern African specimens.

| Catalogue Number | Sex | Date | Locality |
|---|---|---|---|
| MCZ 48617 | ♂ | 02.03.06 | Wells Beach, Maine |
| USNM 175019 | ♀ | 26.07.12 | Beaufort, North Carolina |
| BM 1920 5.20.1 | ♂ | 07.06.17 | Liscannor, Ireland |
| AMNH 90053 | ♀ | 14.01.34 | Long Island, New York |
| YPM 0-2430 | ♀ | 19.11.37 | Mason Island, Connecticut |
| MCZ 37274 | ♀ | 05.08.38 | Cape Breton Island, Nova Scotia |
| ANSP 20484 | — | 09.01.40 | Island Beach, New Jersey |
| NCSM 401 | ♀ | March 1940 | Oregon Inlet, North Carolina |
| AMNH 174293 | ♂ | July 1955 | Flagler Beach, Florida |

Table 16:

External measurements to the nearest 5 mm (except Nos. 16 and 18) of five South African specimens of *Mesoplodon mirus*. Measurement numbers are keyed to Table 2.

| Measurement | PEM 1514/90 ♂ | PEM 1514/38 ♀ | PEM 1514/39 ♂ | PEM 1516/45 ♀ | PEM 1516/46 ♂ |
|---|---|---|---|---|---|
| 1 | 4 650 | 4 850 | 3 405 | 5 105 | 2 325 |
| 2 | 635 | 585 | 470 | 660 | 330 |
| 4 | 400 | 395 | 305 | 470 | 205 |
| 5 | 710 | 675 | 550 | 780 | — |
| 6 | 115 | 90 | 75 | 125 | — |
| 7 | 230 | 205 | 180 | 205 | 115 |
| 8 | 345 | 320 | 265 | 330 | 215 |
| 9 | 620 | 570 | 460 | 635 | 300 |
| 10 | 1 080 | 1 065 | 790 | 1 145 | 520 |
| 11 | — | — | — | 3 125 | 1 420 |
| 12 | 3 405 | 3 355 | 2 360 | 3 455 | 1 615 |
| 13 | 2 335 | 2 210 | 1 575 | 2 745 | 1 120 |
| 14 | 3 175 | 3 405 | 2 285 | 3 610 | 1 550 |
| 15 | 3 505 | 3 505 | 2 415 | 3 735 | 1 700 |
| 16 | 19 | 25 | 13 | 13 | 6 |
| 17 | 470 | — | 380 | — | 585 |
| 18a | 89 | 38 | 38 | 64 | 45 |
| b | 51 | 32 | 25 | 38 | 32 |
| e | 76 | 32 | 35 | 38 | 25 |
| 19a | 205 | 240 | 170 | 305 | 140 |
| b | 205 | 240 | 170 | 280 | 200 |
| 20 | 2 540 | 2 080 | 1 525 | 2 235 | 1 195 |
| 21 | 2 945 | 2 640 | 2 030 | 2 490 | 1 320 |
| 22 | 1 830 | 1 625 | 1 320 | 1 675 | 825 |
| 23 | 40 | 35 | 30 | 45 | — |
| 24a | 50 | 85 | 25 | — | 25 |
| b | 65 | 85 | 30 | 90 | 25 |
| 25a | 180 | 230 | 110 | 205 | 75 |
| b | 75 | 100 | 100 | 20 | 50 |
| 26 | 100 | 120 | 85 | 100 | 65 |
| 27 | 535 | 510 | 355 | 560 | 305 |
| 28 | 355 | 400 | 265 | 305 | 180 |
| 29 | 165 | 145 | 95 | 135 | 70 |
| 30 | 210 | 180 | 140 | 205 | 110 |
| 31 | 380 | 380 | 240 | 610 | 255 |
| 32 | 1 295 | 1 120 | 840 | 1 195 | 560 |
| 33 | 395 | 370 | 290 | 380 | 215 |

In Table 17, applicable external measurements of six northern hemisphere *M. mirus* (from Moore and Wood, 1957) are compared with those of five southern African specimens from Table 16. The proportional lengths of the gape, flipper and dorsal fin base (measurements 4, 27 and 31) appear to be slightly greater in the southern African specimens but the differences are relatively small and it is possible that they have arisen through different measuring techniques.

Comparison of the cranial and mandibular measurements of the six southern African specimens (McCann and Talbot, 1963; present study, Tables 18 and 19) with those of nine northern hemisphere specimens (Moore and Wood, 1957; Ross and Moore, manuscript) indicates that the two groups differ slightly in one of these measurements only; cranial measurement 31, the greatest width of the premaxillae anterior to the superior nares. This width exceeds 120 mm in the four adult southern African *M. mirus* (120, 136 and 139 mm, and 126 mm

TABLE 17:

Comparison of external measurements of six northern hemisphere *Mesoplodon mirus* (from Moore and Wood, 1957) and five southern hemisphere *Mesoplodon mirus*. Measurement No. 1 is in mm. Other measurements are expressed as percentages of body length. Measurement numbers are keyed to Table 2.

| | Northern specimens | | | | | | Southern specimens | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Meas. No. | Beau | Flag | Edge | Bret | IslB | Oreg | PEM 1514/90 | PEM 1514/38 | PEM 1514/39 | PEM 1516/45 | PEM 1516/46 |
| 1 | 4 870 | 4 394 | 4 870 | 5 106 | 4 870 | 5 180 | 4 650 | 4 850 | 3 400 | 5 100 | 2 325 |
| 2 | 13,3 | 13,6 | 13,2 | 11,6 | 12,8 | 12,3 | 13,6 | 12,0 | 13,8 | 12,9 | 14,2 |
| 4 | 7,9 | 7,5 | — | — | — | — | 8,6 | 8,1 | 8,9 | 9,0 | 8,7 |
| 9 | 12,5 | 12,7 | — | — | — | — | 13,3 | 11,7 | 13,4 | 12,4 | 12,8 |
| 10 | 23,9 | 23,7 | 23,3 | 22,7 | 24,5 | — | 23,2 | 21,9 | 23,1 | 22,4 | 22,4 |
| 11 | 58,7 | 64,7 | 61,6 | — | 58,4 | — | — | — | — | 61,2 | 61,2 |
| 12 | — | — | — | — | — | — | 68,8 | 64,3 | 65,3 | 67,6 | 69,4 |
| 14 | — | 61,8 | — | — | — | — | 68,3 | 70,2 | 67,1 | 70,6 | 66,6 |
| 15 | 71,7 | — | — | — | 70,4 | — | 76,1 | 72,3 | 70,8 | 73,1 | 73,2 |
| 26 | 2,3 | 2,6 | — | — | — | — | 2,2 | 2,5 | 2,4 | 2,0 | 2,8 |
| 27 | 10,9 | 9,5 | — | 9,1 | 9,7 | 6,9 | 11,5 | 10,5 | 10,4 | 10,9 | 13,1 |
| 29 | — | 2,9 | — | 3,0 | 2,9 | 2,9 | 3,5 | 3,0 | 2,8 | 2,6 | 3,0 |
| 30 | — | — | — | 5,6 | 4,2 | 4,7 | 4,6 | 3,7 | 4,1 | 4,0 | 4,6 |
| 31 | — | — | 5,7 | 7,7 | 7,6 | 7,5 | 8,2 | 7,9 | 7,1 | 11,9 | 10,9 |
| 32 | 23,9 | — | — | 25,2 | 21,4 | 20,6 | 27,9 | 23,0 | 24,6 | 23,4 | 24,0 |

in SAM 33295, not 115 mm as given by McCann and Talbot, 1963) but is less in northern hemisphere specimens (104, 111, 114, 115, 117, 118, 122 mm). The two groups also differ in one additional cranial measurement. The least distance from the centre of the left orbit to the superior nares exceeds 150 mm in adult *M. mirus* from southern Africa (151, 155, 157, 161 mm) but is less in northern hemisphere specimens (141, 142, 143, 144, 145, 145, 147, 147, 148 mm).

In a taxonomic comparison of northern hemisphere *M. mirus* with *M. europaeus*, Moore (1960) listed 25 propositions pertaining to cranial features against which the available material could be tested. These propositions have been rearranged here (Table 20) and reworded slightly to limit their characterization to the northern hemisphere sample of *M. mirus*, and their positions are illustrated in Plate 1.

The manner in which the nine northern hemisphere and six southern hemisphere *M. mirus* conform to or differ from these propositions is shown in Table 21. This comparison indicates that the southern hemisphere sample differs entirely from the northern sample in only one proposition (no. 1); in the six southern African specimens the right lacrimal bone extends less than 10 mm anteriorly beyond the maxilla to form the apex of the antorbital tubercle. In two other propositions (nos. 2 and 3) all six of the southern African sample differ from the propositions as they applied to the northern hemisphere sample in which one specimen differs in each case. Both samples conform entirely to nine of the propositions.

An additional cranial feature applicable to adult males only is the degree to which the mesorostral canal becomes ossified. In the only adult male known from the northern hemisphere (Liscannor, Ireland) the mesorostral ossification does not rise above the premaxillary rims of the canal (Harmer, 1924). In both adult males known from southern Africa (SAM 33295, PEM 1514/90) the mesorostral ossification rises above the level of the premaxillaries for a considerable portion of its length (Plate 1). The taxonomic significance of this difference cannot be evaluated without further material, for the ossification of the mesorostral cartilage is progressive with age and may continue throughout life.

Examination of photographs of the Western Australian skull shows that it closely resembles the southern African specimens in those characters not requiring measurements or direct examination. This skull differs from the proposed characters in propositions 1–4, 6, 7 and 24, and conforms to propositions 9, 13–15, 17–22 and 25.

In summary, the southern African sample of *M. mirus* differs from the northern hemisphere sample in one of 47 cranial measurements (Table 3), in one additional cranial measurement, none of 13 mandibular measurements and one of 25 descriptive characters of the cranium. While these few differences indicate that the northern and southern populations are distinct in other respects they are extremely similar and there is little doubt that they belong to a single species.

In view of the lack of information on the distribution of populations and the fluid state of cetacean systematics in general, the validity of subspecific rank in cetacean systematics has been questioned and would probably serve little purpose for *M. mirus* at our present level of knowledge. However, evidence is accumulating to show that several species of *Mesoplodon*, including *M. mirus*, are limited in distribution to certain sections of an ocean (Moore, 1963b, 1966). The available data suggest that *M. mirus* has an anti-tropical distribution (see below under Distribution) and is absent between latitudes 30° N and 30° S, suggesting that the northern and southern populations are discrete. If further material confirms the differences found between the small samples presently known, these populations may warrant recognition at the subspecific level.

## DESCRIPTION

The external appearance of a 4,85 m adult female, PEM 1514/38, is illustrated in Fig. 8. External measurements are provided in Table 16.

The body of *M. mirus* is robust, deep and laterally compressed. The melon is bulbous anterior to the blowhole and slopes relatively steeply and smoothly into the short beak. The dorsal fin is small, triangular or slightly falcate in shape and is placed two-thirds of body length from the tip of the beak. The tail flukes are broad laterally and relatively narrow antero-posteriorly. There is no caudal notch. The flipper is small with a rounded apex. In PEM 1514/38 the flippers fitted into a slight depression on the body. A similar depression was noted by Raven (1937) and Ulmer (1941) in two specimens of *M. mirus* but these authors attributed it to post-mortem effects. This was not the case in the present specimen.

The adult female, on which Fig. 8 is based, stranded alive at approximately 18h00 and was photographed after death at 23h30, prior to post-mortem darkening and possible loss of the colour pattern. The underside of the jaw, the posterior portion of the body, the area enclosing the genital aperture, the dorsal fin and underside of the flukes were white. The edges of the jaw and the throat were speckled with blue-black on a light grey background and the back,

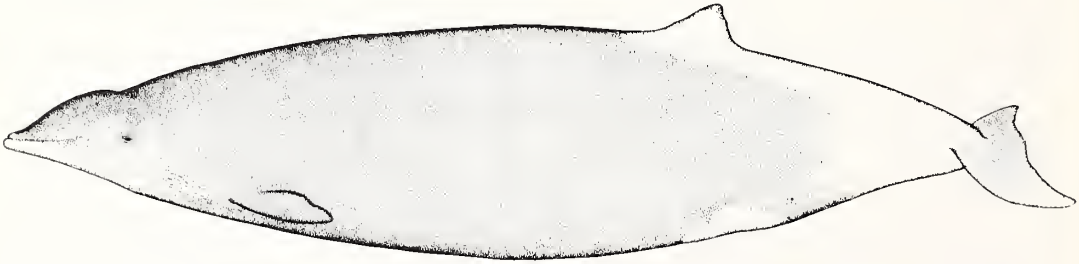


Fig. 8. Adult female *Mesoplodon mirus*, 4,85 m in length, from the eastern Cape (PEM 1514/38).

TABLE 18:

Cranial measurements in mm of *Mesoplodon mirus* from the SE coast of southern Africa. Measurement numbers are keyed to Table 3.

| Meaurement Number | PEM 1514/38 ♀ | PEM 1514/39 ♂ | PEM 1514/90 ♂ | PEM 1516/45 ♀ | PEM 1516/46 ♂ |
|---|---|---|---|---|---|
| 1 | 768 | (620) | 808 | 839 | (449) |
| 2 | 456 | (353) | 490 | 527 | (249) |
| 3 | 582 | (461) | 627 | 660 | (323) |
| 4 | 613 | (487) | 660 | 689 | (346) |
| 5 | 398 | (300) | 402 | 459 | (215) |
| 6 | 487 | (367) | 504 | 559 | — |
| 7 | 705 | (555) | 728 | 782 | (387) |
| 8 | 552 | (429) | 570 | 618 | (290) |
| 9 | 577 | (461) | 603 | 646 | (321) |
| 10 | 727 | (581) | 758 | 810 | (320) |
| 11 | 621 | (498) | 637 | 694 | (337) |
| 12 | 443 | (330) | 454 | 492 | (223) |
| 13 | 125 | 102 | 133 | 155 | 82 |
| 14 | 107 | 98 | 115 | 119 | 68 |
| 15 | 55 | 43 | 56 | 53 | 26 |
| 16 | 54 | — | (66) | — | — |
| 17 | 358 | 280 | 386 | 382 | 205 |
| 18 | 342 | 276 | 380 | 368 | 200 |
| 19 | 349 | 270 | 366 | 358 | 185 |
| 20 | 203 | 190 | 238 | 224 | (167) |
| 21 | 124 | 109 | — | 126 | 87 |
| 22 | 46 | 40 | — | 51 | 30 |
| 23 | 82 | 81 | — | 104 | 47 |
| 24 | 47 | 49 | — | 45 | 44 |
| 25 | 284 | 230 | 299 | 297 | 175 |
| 26 | 36 | 34 | 48 | 42 | 25 |
| 27 | 13 | 8 | 19 | 18 | 17 |
| 28 | 14 | (2) | 5 | 7 | 7 |
| 29 | 151 | 140 | 180 | 170 | 91 |
| 30 | 110 | 102 | 126 | 124 | 79 |
| 31 | 120 | 108 | 136 | 139 | 82 |
| 32 | 31 | — | 44 | 33 | — |
| 33 | 211 | 170 | 244 | 223 | 118 |
| 34 | (154) | 130 | 171 | (165) | — |
| 35 | 62 | (58) | 88 | 70 | — |
| 36 | 49 | — | 63 | 47 | — |
| 37 | 60 | 48 | 54 | 60 | 33 |
| 38 | 87 | 73 | 110 | 107 | 58 |
| 39 | 322 | 260 | 341 | 346 | 176 |
| 40 | 56 | 47 | (70) | 65 | (40) |
| 41 | 88 | 81 | 107 | 103 | 56 |
| 42 | 32 | 27 | 48 | 45 | 19 |
| 43 | 75 | (59) | 81 | 75 | 31 |
| 44 | 137 | 85+ | 153 | 215 | — |
| 45 | — | 80 | 30* | — | 80 |
| 46 | 42 | 40 | (42) | 43,5 | 42 |
| 47 | 43 | 42 | 44 | 45 | 43 |

( ) denotes approximate measurement.
* 30 mm added for missing condyles.

sides and belly of the anterior half of the animal were dark blue-black. This colour pattern has not been recorded previously for *M. mirus*. By mid-morning the following day almost all trace of the colour pattern had disappeared.

It is possible that the colour patterns of specimens described by True (1913), Raven (1937) and Moore and Wood (1957) had darkened after death, obscuring details of the colour pattern. It is also possible that this colour pattern is typical of southern hemisphere *M. mirus* (Ross *et al.*, in prep.).

The calf stranded with PEM 1514/38 was cloud-grey on the head, sides and belly (excepting the mid-ventral region which was not inspected) merging gradually into the dark blue-grey of the back. This specimen is described and figured in more detail by Ross *et al.* (in prep.).

Cranial and mandibular measurements are provided in Tables 18 and 19, and relevant cranial features have been discussed above (Tables 20 and 21, Plate 1). The tympanic bulla of *M. mirus* is illustrated in Fig. 29.

The vertebral formula of PEM 1516/45 is C7 T11 L13 Cd17 (+1) = 48 (+1); the terminal caudal vertebra is missing. The vertebrae of PEM 1516/46 are too fragmented to determine their total number with any accuracy. Harmer (1924) gives the vertebral formula of the Liscannor male as C7 T10 L10 Cd19 (+1 or 2) = 46 (+1 or 2), while two specimens examined by Raven (1937) and Ulmer (1941) each had the formula C7 T10 L11 Cd18 = 46.

### Biology

*Age determination*: Teeth from five PEM specimens were examined for their potential in age determination. Longitudinal sections of four of these teeth are illustrated in Plate 2, and one tooth of PEM 1516/46 was examined in a half section with reflected light.

In the youngest animal (PEM 1516/46) the tooth is comprised of a hollow cone of dentine capped distally with enamel and covered proximally by a thin layer of cement. The dentine is composed of a layer of prenatal dentine approximately 700 $\mu$ thick near the apex of the pulp cavity and a thin layer of postnatal dentine some 60 $\mu$ thick. A poorly defined neonatal line separates these two layers. The thin postnatal dentine is consistent with the apparent youth of this animal in which the umbilicus was only partially healed.

Table 19:

Mandibular measurements in mm of *Mesoplodon mirus* from southern Africa. Measurement numbers are keyed to Table 4.

| Measurement Number | SAM 33295 ♂ | PEM 1514/90 ♂ | PEM 1514/38 ♀ | PEM 1514/39 ♂ | PEM 1516/45 ♀ | PEM 1516/46 ♂ |
|---|---|---|---|---|---|---|
| 1 | 656 | 698 | 661 | 523 | 735 | 323 |
| 2 | 158 | 154 | 171 | 101 | 193 | — |
| 3 | — | 108 | 115 | 84 | 127 | 68 |
| 4 | 36 | 32 | 28 | 25 | (30) | — |
| 5 | 34 | 32 | (28) | 25 | — | — |
| 6 | 505 | 552 | 490 | 421 | 547 | — |
| 7 | 627 | 647 | 625 | 490 | 610 | — |
| 8 | 25 | 45 | 30 | 20 | 45 | — |
| 9 | 12 | (15) | 8 | 7 | 9 | — |
| 10 | 7 | — | (2) | 6 | 7 | — |
| 11 | 50 | 48 | 31 | 26 | 34 | 24 |
| 12 | 18 | 19 | 10 | 10,5 | 12 | 9 |
| 13 | 10 | 12 | 8 | 7 | 6 | 6 |

( ) denotes approximate measurement.

The tooth of PEM 1514/39 (Plate 2a) is similar in structure. The prenatal dentine is approximately 700 μ thick near the apex of the pulp cavity. The postnatal dentine contains one growth layer 840 μ thick near the apex and part of a second layer about 280 μ thick. The thickness of the cement layer near the base of the tooth is about 220 μ.

In the teeth of both adult females (PEM 1514/38, Plate 2b; 1516/45, Plate 2c) 11 or 12 postnatal dentine growth layers are visible between the neonatal line and the uniform, translucent secondary dentine which obliterates the pulp cavity in PEM 1514/38 and nearly does so in PEM 1516/45. Subsequently the tooth appears to be lengthened by the transverse deposition of dentine across the base of the tooth. The dentinal tubules in this region are oriented along the longitudinal axis of the tooth. The dentine-cement junction around the base of the tooth is relatively broad, vacuolated and has a chalky appearance in reflected light. The base of the tooth is formed by a broad layer of cement which becomes progressively thinner towards the ventral edge of the enamel.

The tooth of the adult male (PEM 1514/90, Plate 2d) appears quite different from those of the adult females in size and proportions but the structure of the tooth is essentially the same. Initially dentine is deposited in the pulp cavity in concentric layers. In this tooth about ten poorly-defined growth layers can be seen before translucent dentine obliterates the pulp cavity. Most of the length of the tooth consists of dentine deposited transversely on the base of this "core". The initial deposition is similar to the longitudinally oriented dentine described in the teeth of the two adult females. Dentine deposited subsequently consists partly of translucent secondary dentine and partly vacuolated dentine similar in appearance to the cement-dentine junction in the teeth of the adult females. Cement is deposited in a broad layer along the length of the tooth, thinly over the base, and in parts appears to invade the vacuolated dentine laterally and basally.

The structure of the basal portion of *M. layardi* and *M. bidens* teeth appears to be similar to that of male *M. mirus* in all respects except proportions. The vacuolated dentine described above is termed vaso-dentine by Turner (1880) and constitutes the bulk of the tusk-like basal portion of *M. layardi* teeth. However, Boyde (1968) indicates that this same tissue is derived from the cementum and terms it vaso-cementum. Thus the true affinities of the vacuolated tissue in *M. mirus* teeth require clarification.

The lack of distinctive layers in dentine deposited after the pulp cavity closes precludes interpretation of even relative ages in this small sample. It is clear that considerable growth occurs in males once the pulp cavity is filled. In females tooth growth may cease shortly after the pulp cavity closes, or take place very slowly, for the vertebral epiphyses in PEM 1516/45 are all fused to their centra, indicating the attainment of physical maturity. It appears that age determination based on dentine layer counts will be restricted to young animals in which the pulp cavity is still open.

*Growth and development*: The length at birth is estimated to be about 2,2 m, based on the lengths of the near term foetus, 2,185 m in length, described by Brimley (1943) and the 2,325 m calf stranded at Plettenberg Bay (PEM 1516/46). In the latter animal the umbilicus was partially healed and some postnatal dentine had been deposited suggesting a birth length slightly less than the length at stranding.

The greatest total lengths recorded for three adult male *M. mirus* are 4,65 m and 5,33 m (present study) and *c.* 5, 18 m (Harmer, 1924; physically mature). The lengths of seven adult females were 4,85 m (present study), 4,87 m (Raven, 1937), 4,88 m (True, 1913), 4,88 m (Ulmer, 1941; physically mature), 5,03 m (Allen, 1939a), 5,10 m (present study; physically mature) and 5,18 m (Brimley, 1943). Fraser (1934) reported a 5,33 m long specimen, thought to be a female as the teeth were not erupted. These few data suggest that there is little difference in the average lengths of male and female *M. mirus*.

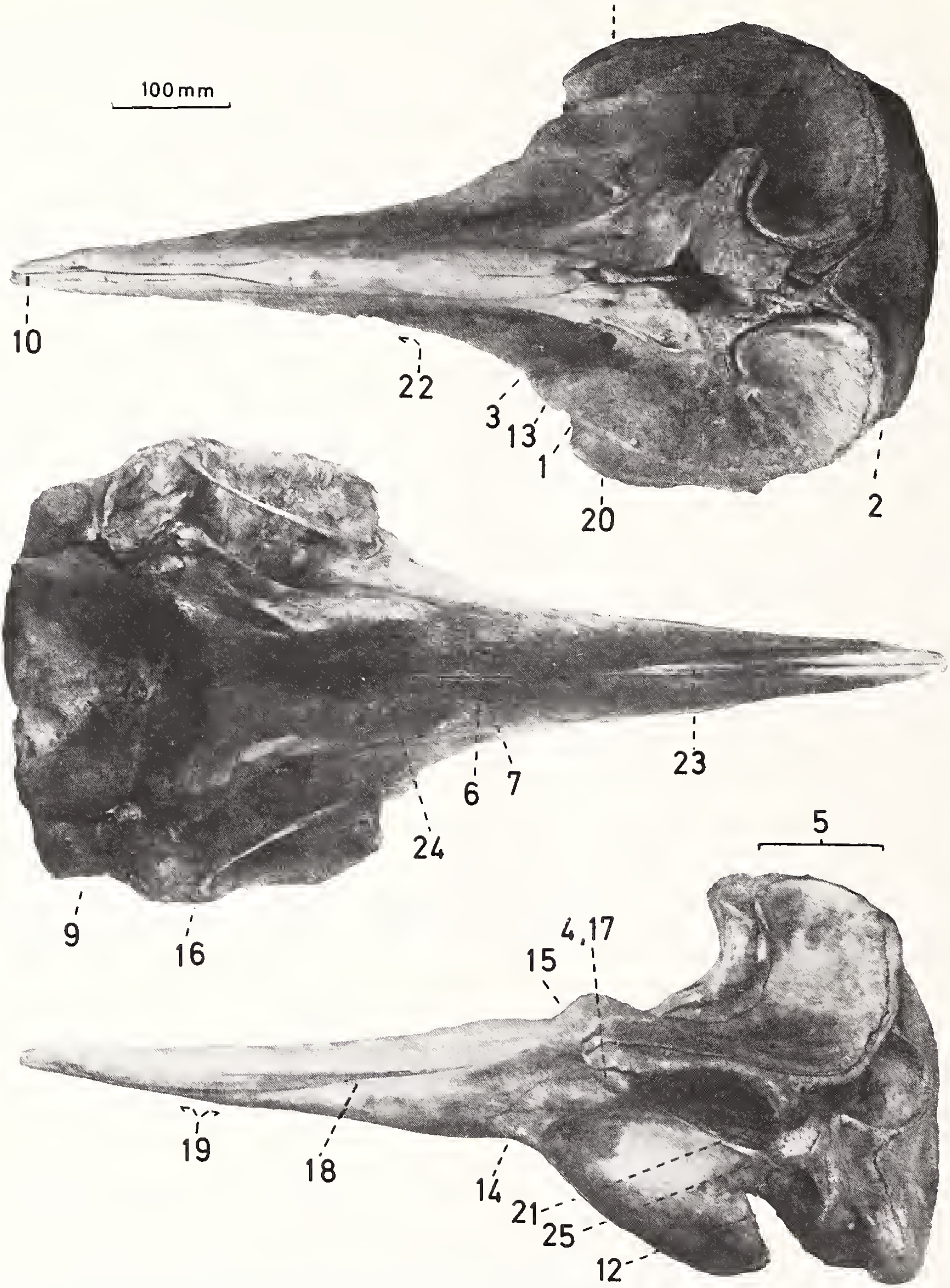


Plate 1. Dorsal (top), ventral (middle) and lateral views of the cranium of *Mesoplodon mirus* (PEM 1514/90) illustrating the features tested for their taxonomic value. The numbers are keyed to Table 20.

Table 20:

Propositions of potential taxonomic value pertaining to cranial features in *Mesoplodon mirus* from the North Atlantic, re-arranged from Moore (1960).

---

1 ANTORBITAL TUBERCLE: The lacrimal extends beyond the maxilla 10 mm or more, at least on the right side, to form the apex of the antorbital tubercle.
2 SUPRAOCCIPITAL: From posterior view the dorsolateral slope of the margin of the supraoccipital is flat in outline rather than arched.
3 MAXILLARY PROMINENCE: Each maxillary prominence protrudes anteriorly so far into the lateral margin of the rostrum that a notch forms in the margin, at least on the left side if not on both.
4 LACRIMAL: The external free border of the lacrimal is about one-half the length of the orbit.
5 MAXILLARY PLATE: The greatest antero-posterior width of the post-narial, dorsal extension of the left maxillary plate measured parallel to the long axis of the rostrum is about two-thirds of the greatest span of the premaxillaries.
6 APEX OF PALATINE: Each palatine bone ends anteriorly in a single point.
7 ROSTRAL KEEL: The ventral surface of the rostrum just anterior to the pterygoids is smoothly rounded without a sagittal keel.
8 LENGTH OF MANDIBULAR SYMPHYSIS: The length of the mandibular symphysis is more than 26% of the length of the mandible.
9 MARGIN OF VOMER: The broad posterior margin of the vomer where it emerges posteriorly from the inferior nares, is marked in the midline by an acute-angled notch.
10 APEX OF ROSTRUM: Towards the apex of the rostrum where the pre-maxillae form the sides and bottom of it they diverge naturally from the median line, creating between them a long narrow notch. (Even if drying splits these bones apart further, close examination will reveal where the natural division begins.)
11 TEMPORAL FOSSA: The width of the temporal fossa is 25–45 per cent of its length.
12 PTERYGOID NOTCH: The greatest width of the notch in the posterior margin of each wing of the pterygoid is narrower than 0,45 of its greatest length.
13 MAXILLARY PROMINENCES: The maxillary prominences flanking the base of the rostrum are short, raised and directed anteriorly but obliquely laterad from the long axis of the skull.
14 ROSTRO—PTERYGOID PROFILE: From side view the ventral outlines of the rostrum and the pterygoids adjoin in a gentle curve.
15 MAXILLARY PROMINENCE: The anterior slope of the maxillary prominence is abrupt.
16 PTERYGOID RIDGE: The inferior surface of the pterygoid is convex and devoid of the oblique ridge described for *M. europaeus*, which begins at or near the junction of the posterior edge of the pterygoid with the mid-sagittal plane and extends obliquely laterad almost the whole length of the ventral surface of the pterygoid. (A difference in texture of the bone surface, however, may take place along a corresponding line.)
17 ANTORBITAL TUBERCLE: The frontal is extended anteriorly from the orbit to form a large proportion of the antorbital tubercle, and the lacrimal appears reduced to a thin layer wrapped around the protrusion of the frontal.
18 MAXILLARY BEVEL: On the dorsal surface at about the mid-length of the rostrum a sharp change in slope of the maxilla begins at the outside edge and angles forward to the inside edge. Posterior to this the surface of the maxilla is level or slopes gently toward the mid-sagittal plane; anterior to it the slope is outward and steep.
19 ROSTRAL PROFILE: The ventral outline of the rostrum is straight.
20 PREMAXILLARY FORAMINA: The right premaxillary foramen is in contact with, or posterior to, a line connecting the anterior margins of the maxillary foramina. Location of an anterior margin is, *ad hoc*, accomplished by arbitrarily treating the foramina which lack anterior margins as if there were the same shape as the posterior "half" of the foraminal margin.
21 POSTORBITAL PROCESS: The postorbital process of the frontal thickens and becomes truncated at the end.
22 ROSTRUM, LATERAL MARGIN: Anterior to the concave basal curve, the external free margin of the rostrum proceeds towards the tip in a straight line.
23 VOMER: The vomer appears in the mid-sagittal plane on the ventral surface of the rostrum as an elongated fusiform ridge with a naturally exposed length about one-third that of the rostrum.
24 PALATINES: The maxillae extend posteriorly between the pterygoids, separating the palatines and preventing their meeting.
25 ZYGOMATIC PROCESS: The zygomatic process of the squamosal is relatively robust.

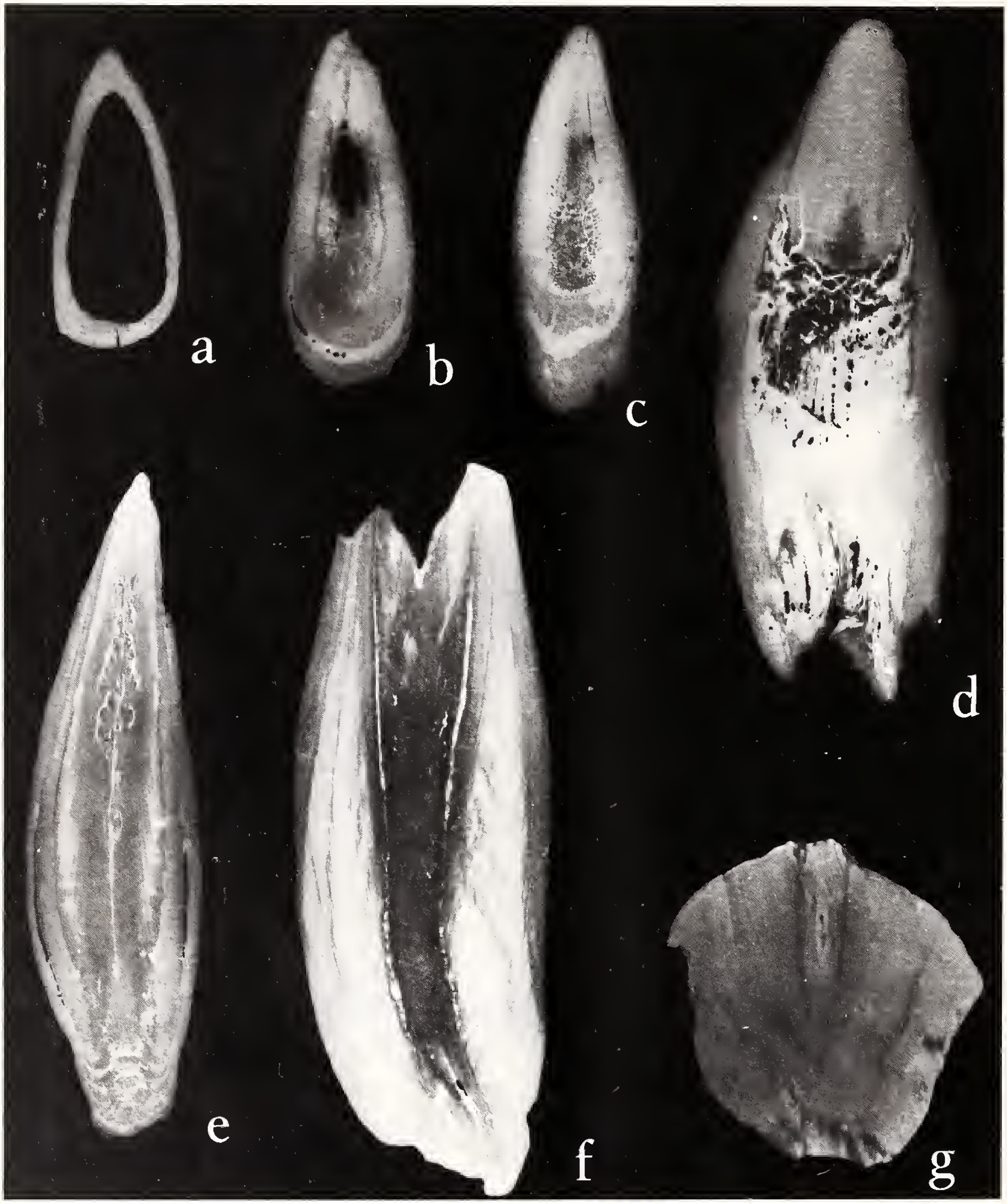


Plate 2. Midsagittal sections of ziphiid teeth. *Mesoplodon mirus*:—a. imm. ♂, PEM 1514/39; b. ad. ♀, PEM 1516/45; c. ad. ♀, PEM 1514/38; d. ad. ♂, PEM 1514/90. *Ziphius cavirostris*:—e. ad. ♀, PEM 1514/08; f. ad. ♂, ELM 857; g. ad. ♂, PEM 1520/01. The photographs were made using the teeth as negatives in transmitted light.

TABLE 21:

Variation in nine North Atlantic *Mesoplodon mirus* and six southern African *Mesoplodon mirus*, as they conform to (C), partially conform to (C?), differ from (D) or partially differ from (D?) the 25 cranial features proposed in Table 20 and figured in Plate 1.

| Characters | North Atlantic | | | | Southern Africa | | | |
|---|---|---|---|---|---|---|---|---|
| | C | C? | D | D? | C | C? | D | D? |
| 1 | 9 | 0 | 0 | 0 | 0 | 0 | 6 | 0 |
| 2 | 8 | 0 | 1 | 0 | 0 | 0 | 6 | 0 |
| 3 | 8 | 0 | 1 | 0 | 0 | 0 | 5 | 1 |
| 4 | 7 | 0 | 2 | 0 | 0 | 0 | 6 | 0 |
| 5 | 7 | 0 | 2 | 0 | 1 | 0 | 5 | 0 |
| 6 | 7 | 0 | 2 | 0 | 0 | 0 | 4 | 2 |
| 7 | 6 | 1 | 2 | 0 | 0 | 0 | 5 | 1 |
| 8 | 7 | 0 | 1 | 0 | 1 | 0 | 4 | 0 |
| 9 | 7 | 1 | 1 | 0 | 2 | 0 | 3 | 0 |
| 10 | 8 | 0 | 0 | 0 | 0 | 0 | 3 | 1 |
| 11 | 5 | 0 | 4 | 0 | 0 | 0 | 5 | 0 |
| 12 | 7 | 0 | 0 | 0 | 2 | 0 | 3 | 0 |
| 13 | 9 | 0 | 0 | 0 | 6 | 0 | 0 | 0 |
| 14 | 9 | 0 | 0 | 0 | 6 | 0 | 0 | 0 |
| 15 | 9 | 0 | 0 | 0 | 6 | 0 | 0 | 0 |
| 16 | 9 | 0 | 0 | 0 | 6 | 0 | 0 | 0 |
| 17 | 9 | 0 | 0 | 0 | 5 | 1 | 0 | 0 |
| 18 | 9 | 0 | 0 | 0 | 5 | 0 | 0 | 0 |
| 19 | 8 | 1 | 0 | 0 | 4 | 0 | 0 | 0 |
| 20 | 9 | 0 | 0 | 0 | 6 | 0 | 0 | 0 |
| 21 | 9 | 0 | 0 | 0 | 3 | 2 | 0 | 0 |
| 22 | 9 | 0 | 0 | 0 | 4 | 0 | 0 | 0 |
| 23 | 8 | 0 | 0 | 0 | 4 | 0 | 0 | 0 |
| 24 | 6 | 0 | 3 | 0 | 5 | 0 | 0 | 0 |
| 25 | 3 | 0 | 0 | 0 | 5 | 0 | 0 | 0 |

There appear to be no published mass data for *M. mirus* other than the heart mass (4,77 kg) of the type specimen (True, 1913). The 5,10 m female, PEM 1516/46, was weighed in pieces during fleshing. The blubber and epiaxial and hypoaxial fillets (meat mass) from the right side only were weighed and doubled. The mass of the whole animal in pieces was 1 394 kg, and allowing 10% loss of body fluids during dissection, estimated at a total mass of 1 533 kg. The mass of various parts, expressed as percentages of total mass were blubber, 17,9; meat, 40,9; head, 5,1; heart, lungs and trachea, 1,6; heart, 0,42; liver, 0,82; one kidney, 0,13; digestive tract, 1,6; reproductive tract, 0,19.

The 2,325 m calf, PEM 1516/46, was weighed in pieces totalling 136,4 kg. The total estimated mass corrected for 10% loss of body fluids during dissection is 150 kg.

True (1913) recorded the intestinal length of the type specimen as 68 feet (20,7 m ), or 4,25 times body length.

*Reproduction*: Very little is known concerning reproduction in *M. mirus*. The ovaries of the two adult females (PEM 1514/38, 1516/45) were sectioned and examined by Dr P. Best (*in litt.*). Details of these ovaries are given in Table 22. The total number of corpora in PEM 1514/38 was 13. The largest corpora albicantia in this animal were similar in size, suggesting that lactation must have been in progress for some time.

The gradation in size of the corpora albicantia in PEM 1514/38 suggests that corpora regress with age. It is not clear whether the smallest of these (4 mm) represents the smallest size attained by old corpora for many of the measured corpora were inconspicuous and smaller corpora may well have been missed completely.

The two corpora albicantia found in the ovaries of PEM 1516/45 seem surprisingly few since this animal was physically mature. The large number of atretic follicles is probably consistent with advanced age. As this female was still reproductively active she cannot be classed as a 'senile' female in the sense used by Sergeant (1962b) and Perrin *et al.* (1976) for post-reproductive females with low corpora counts.

PEM 1514/38 was pregnant, carrying a foetus 105 mm in length, and lactating strongly when she stranded with a 3,4 m male which was considered to be her calf on the basis of a milk-like substance found in his stomach. PEM 1516/45 was lactating moderately, and the male calf accompanying her had milk in his stomach. The mammary gland of this female was approximately 40 mm wide, tapering anteriorly, and extended as far as the umbilicus (approximately 850 mm).

The calving season is unknown. The one near-term foetus from North Carolina (Brimley, 1943) and neonatal animal from Plettenberg Bay (PEM 1516/46) were both recorded in March. If this species has a distinct calving season, it would be reasonable to expect northern and southern hemisphere dates to be out of phase by six months (as has been recorded for several other widely distributed cetaceans). The present limited sample suggests that the calving season is extended over several months.

The 3,4 m male (PEM 1514/39) was originally mis-sexed as a female (Ross, 1969) through inexperience on the part of the observer. The testes of this animal were 51 × 15 mm; 6,0 g, and 53 × 15 mm; 6,5 g. The mean testis tubule diameter was 23 $\mu$. In histological section the tubules were widely scattered in interstitial tissue occupying approximately 10 per cent of the section surface area.

*Food and feeding*: There are no published reports on stomach contents in *M. mirus*, though Ulmer (1941) mentioned that the stomach he examined contained a brownish fluid.

The stomach of PEM 1514/38 contained two upper beaks and four lower beaks of a common inshore squid *Loligo reynaudi*. The rostral lengths of the lower beaks were 2,6; 2,7; 2,8; and 3,0 mm. The stomach of PEM 1516/45 was empty and that of PEM 1514/90 was not examined.

Table 22:

Data on ovaries from two female *Mesoplodon mirus* from southern Africa, examined by Dr P. Best.

| Catalogue Number | Ovary | Mass (g) | Corpus luteum diameter (mm) | Corpora albicantia diameter (mm) | Remarks |
|---|---|---|---|---|---|
| PEM 1514/38 | Right | 48,5 | 33 | 9; 6,5; 6; 6; 5,5; 5 | Corpus luteum 32g, no cavity. Few follicles up to 5 mm. Surface smooth. |
| | Left | 14 | 0 | 9; 6,5; 5; 5; 4,5; 4 | Few follicles up to 4 mm. Surface smooth. |
| PEM 1516/45 | — | 12,1 | 0 | 6,5 | Moderate number of follicles, several atretic, largest non-atretic 4 mm. Surface smooth. |
| | — | 10,7 | 0 | 19 | Moderate number of follicles, several atretic, largest non-atretic 5 mm. |

*Parasites*: A group of 53 parasitic barnacles *Xenobalanus globicipitis* up to 30 mm in length were attached to the trailing edge of the flukes of PEM 1514/39. A few barnacles were also attached to the flukes of PEM 1514/38.

The adult females (PEM 1514/38, 1516/45) and young males accompanying them were not examined completely for internal parasites. A few nematodes were found in the stomachs of PEM 1514/38 and 1516/45. Those in the former animals have been identified as *Anisakis simplex*.

No parasites were found in the liver or kidneys of all four animals, in the lungs, blubber or intestine of PEM 1516/45 and 1516/46, or in the nasal passages or air sinuses of PEM 1516/45.

### DISTRIBUTION AND MIGRATION

Fourteen strandings of *M. mirus* has been recorded from the North Atlantic, north of latitude 30° N (Moore and Wood, 1957; Gresson and O'Riordan, 1969). The distribution of the strandings (USA, nine; Nova Scotia, one; Ireland, four; Outer Hebrides, one) has been discussed by Moore (1966) who suggested that *M. mirus* "may inhabit the deeper waters of the continental shelf off the middle Atlantic states of the Unites States" and that stragglers move northwards and north-eastwards with the Gulf Stream towards the British Isles. The four southern African strandings of *M. mirus* occurred within a 300 km stretch of coast suggesting a localized distribution in a global context but the limits of such a distribution cannot be defined in any way on the present data. The species has also been recorded once in Western Australian waters in June 1974 (Mr. J. Bannister, *in litt.*).

Records for the northern hemisphere do not appear to show a seasonal pattern. Eleven dated records occurred in the months of January (2), March (2), April (1), June (1), July (2), August (1), November (1), and December (1).

The southern African strandings occurred in the months of January (1), March (1), May (1) and July (1). The sample size is too small to infer a seasonal pattern.

## ***Mesoplodon densirostris*** (Blainville, 1817)
## Blainville's Beaked Whale

*Delphinus densirostris* Blainville, 1817: 178 (holotype, rostral tip, Museum National d'Histoire Naturelle, Paris; type locality, unknown).

*Mesoplodon densirostris* Flower, 1878: 684 (taxonomy); Sclater, 1901: 195; FitzSimons, 1920: 221; Harmer, 1924: 576; Roberts (in part), 1951: 223; Ellerman, Morrison-Scott and Hayman, 1953: 328; Barnard, 1954: 20; Pringle, 1963: 61; Best, 1971: 2; Robinson, 1976: 148.

### RECORDS AND MATERIAL

Details of 13 specimens of *M. densirostris* stranded within the study region are provided in Table 23. Skeletal material from an adult female, SAM 36301, stranded at St. Helena Bay, Western Cape (32° 46′S, 18° 09′E) was also examined for the study. Some details of a further stranding on the west coast were kindly provided by Dr P. Best (pers. comm.). This specimen, a male 3,95 m in length, stranded at Langebaan (33° 05′S, 18° 02′E) on 27 May 1976. The entire skeleton (SAM 38220) is in the South African Museum.

#### *Specific status and characters*

*M. densirostris* is a distinctive species characterized by a number of cranial and mandibular features. Examination of material from 13 southern African specimens, including the foetus of PEM 1518/84, indicated almost complete conformity with the following cranial characters proposed by Moore (1966) for this species.

In anterior view the premaxillary foramina lie above a line transecting the centres of the maxillary foramina. On the vertex of the skull the right premaxillary extends posteriorly beyond the right nasal for at least 75% of the length of the nasal on the vertex. In lateral view,

TABLE 23:

Records and material of *Mesoplodon densirostris* from the SE coast of southern Africa.

| Catalogue Number | Sex | Total Length (mm) | CBL (mm) | Date | Locality | Comments |
|---|---|---|---|---|---|---|
| 2908 | — | — | — | before 1872 | Near Algoa Bay | Rostrum in Royal College of Surgeons, London (Harmer, 1924) |
| PEM 1496/74 | ♂ | 4 725 | 756 | 27.04.52 | Cape Receife | Skull, mandibles, teeth, few vertebrae in PEM (Pringle, 1963) |
| PEM 1496/75 | ♂* | — | 704 | December 1952 | Near Jeffreys Bay | Skull, mandibles, teeth in SAM on exchange (Pringle, 1963) |
| PEM 1515/56 | ♀ | 4 710 | 800 | 23.06.70 | Maitland River Mouth | Whole skeleton in PEM |
| PEM 1517/11 | — | (2 600) | — | *c.* 15.02.71 | Cape St. Francis | Whole skeleton in PEM |
| PEM 1517/25 | ♀ | — | (841) | 18.05.71 | Robbeberg, Plettenberg Bay | Skull, mandibles, teeth, few vertebrae in PEM |
| PEM 1518/84 | ♀ | 4 330 | 698 | 15.02.74 | Schoenmakerskop | Skull, mandibles, teeth, foetal skull in PEM (female foetus 1 900 mm in length) |
| TNP B/75/3 | ♀ | 2 610 | — | 26.03.75 | Storms River Mouth | Whole skeleton in Tsitsikama National Park collection (Robinson, 1976) |
| PEM 1519/69 | — | (3 850) | — | July 1975 | Wilderness | Skull, mandibles, teeth in PEM |
| PEM 1519/70 | ♀ | 4 560 | 769 | 10.08.75 | Riet Point near Port Alfred | Whole skeleton in PEM |
| — | — | — | — | Before July 1975 | Near Sundays River Mouth | Beach worn cranium collected by Dr. T. Hecht in July 1975 |
| PEM 1520/60 | ♂* | — | 787 | 04.05.77 | St. George's Strand, Algoa Bay | Head only washed up on beach. Skull, mandibles, teeth in PEM |
| PEM 1520/71 | ♂ | 4 150 | 777 | Aug/Sept. 1977** | Kabeljous River Mouth | Entire skeleton in PEM |

* Sexed as male on the form of the mandibular teeth (Besharse, 1971).
** Stranded between 20 August and 5 September.
( ) denotes approximate measurement.

the plane of the lateral and mesial margins of the spiracular plate is continuous with that of the dorsal profile of the rostrum. The rostrum is narrow in dorsal view and deep at midlength in lateral view. The maxillary foramina open directly forward.

In lateral view the truncated proximal ends of the premaxillaries are rounded and their anterior faces are directed antero-ventrally at about 45° to the long axis of the rostrum, at least in adult animals. In younger specimens in the present sample this angle varied from *c* 80° in the foetus of PEM 1518/84 and TNP/B/75/3 to *c*. 70° in PEM 1517/11 and *c*. 60° in PEM 1519/69, 1520/71 and the skull collected by Dr Hecht. This variation is evidently ontogenetic in origin.

Flower (1878) stated that *M. densirostris* has a well-developed basirostral groove. The present material supports the observations of True (1910) and Besharse (1971) that this groove is not well marked in this species but is shallow and indistinct particularly proximally.

The shape of the mandible and the position of the single alveolus are diagnostic for *M. densirostris*. The proximal portion of the mandible is abruptly stepped dorsally in relation to the distal portion giving this bone its characteristic shape (Fig. 5g) and establishing the distinctive line of the gape (Fig. 9). The alveolus is situated on the anterior end of the elevated part of the mandible.

### DESCRIPTION

The external features of a 4,71 m long adult female *M. densirostris* (PEM 1515/56) are illustrated in Fig. 9.

This species has a robust, deep body, laterally compressed particularly in the caudal region. Anterior to the dorsal fin the ventral surface is rounded in cross-section but dorsally the body is markedly angular along the midline.

The beak is moderately long and concealed partly in lateral view posteriorly by the elevated portion of the lower jaw. The melon is comparatively small. The line of the gape is distinctive, rising abruptly at about midlength in lateral view.

The mandibular teeth do not erupt in females. In adult males the erupted tips of the massive teeth rise above the upper jaw and anterior portion of the melon. In PEM 1520/60 the tips of the teeth were elevated about 40 mm above the dorsal surface of the upper jaw.

The flippers are small, convex on both margins and tapering to a rounded apex. The dorsal fin is triangular or falcate, with a convex leading edge. The fin is placed approximately two-thirds of body length from the tip of the beak. The flukes are broad and tapered laterally and lack a caudal notch.

External measurements of eight southern African *M. densirostris* are provided in Table 24. Comparison of these measurements with the few measurements published by Allen (1906), Raven (1942), Guiler (1966), Kasuya and Nishiwaki (1971) and Michel and van Bree (1976) indicates a strong similarity in all the specimens examined to date.

Three of the adults examined in this study were sufficiently fresh to provide some data on the colour pattern in *M. densirostris*. All three were physically mature females.

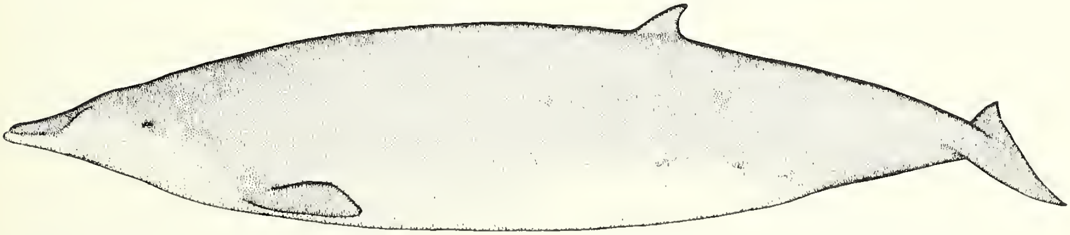


Fig. 9. Adult female *Mesoplodon densirostris*, 4,71 m in length, from the eastern Cape (PEM 1515/56).

TABLE 24:
External measurements of eight *Mesoplodon densirostris* from the SE coast of southern Africa. Total length (No. 1) is in mm. Other measurements are expressed as percentages of total length. Measurement numbers are keyed to Table 2.

| Meas. Nos. | PEM 1518/84 foetus | TNP B/75/3 ♀ | PEM 1519/69 o ? | PEM 1520/71 ♂ | PEM 1518/84 ♀ | PEM 1519/70 ♀ | PEM 1515/56 ♀ | PEM** 1496/74 ♂ |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 900 | 2 610 | (3 850) | 4 150 | 4 330 | 4 560 | 4 710 | 4 725 |
| 2 | 15,3 | 14,5 | (14,3) | 14,2 | 13,9 | 14,5 | 14,2 | — |
| 3 | — | — | — | — | — | — | (9,7) | — |
| 4 | 7,9 | 9,2 | (8,1) | 8,4 | 9,0 | 8,3 | 9,4 | — |
| 5 | 17,9 | 17,0 | — | — | 17,8 | 16,0 | 16,4 | — |
| 6 | 2,9 | 3,0 | — | — | 4,4 | 2,2 | 2,4 | — |
| 7 | 7,9 | 6,1 | (6,5) | 7,0 | 5,1 | 6,3 | 5,4 | — |
| 8 | 9,2 | 8,0 | (7,0) | 7,7 | 6,7 | 7,0 | 5,9 | — |
| 9 | 11,6 | 11,5 | — | 12,8 | 11,8 | 12,3 | 12,4 | — |
| 10 | 26,8 | 25,2 | — | 22,6 | 22,6 | 23,0 | 24,0 | 23,1 |
| 11 | 58,4 | — | (61,0) | 59,8 | 58,0 | 59,2 | — | 60,8 |
| 12 | 65,8 | 63,2 | — | 65,5 | 63,3 | 65,8 | 66,3 | — |
| 13 | 51,0 | 53,6 | — | — | — | — | 53,4* | — |
| 14 | 68,4 | 74,7 | — | 67,8 | 72,7 | 71,0 | 75,5* | — |
| 15 | 72,1 | — | — | 75,4 | 77,8 | 75,4 | 78,2* | 70,0 |
| 16 | 0,3 | 0,4 | — | 0,2 | 0,5 | 0,4 | 0,5 | — |
| 17 (L) | 13,2 | 13,0+ | — | 11,8+ | 10,9 | 12,1 | 11,9+ | — |
| (R) | 13,2 | — | — | — | 10,9 | 12,1 | — | — |
| 18 a | — | 2,1 | — | 1,2 | — | — | 1,3 | — |
| b | — | 1,3 | — | 0,6 | — | — | 0,7 | — |
| c | — | 1,3 | — | 0,8 | — | — | 0,5 | — |
| 19 a | 7,9 | 7,9+ | — | — | 4,6 | 6,6 | 5,1 | — |
| b | 7,9 | 6,7+ | — | 6,2 | 5,1 | 6,6 | 5,7 | — |
| 20 | — | 44,4 | — | — | — | 47,4 | 44,2 | — |
| 21 | — | 52,9 | — | — | — | 53,5 | 48,5 | — |
| 22 | 28,4 | 31,0 | — | — | — | 30,7 | 27,4 | — |
| 23 | 1,2 | 1,2 | — | — | — | 0,8 | 0,7 | — |
| 24 a | 1,3 | 1,7 | — | — | 1,8 | 1,3 | 2,3 | — |
| b | 1,3 | 1,6 | — | — | 2,1 | 2,0 | 2,2 | — |
| 25 a | — | 8,4 | — | — | — | 6,8 | 5,9 | — |
| b | — | 1,0 | — | — | — | 0,8 | 1,1 | — |
| c | 6,8 | — | — | — | 9,9 | 8,8 | — | — |
| 26 | 1,8 | 2,3 | 1,0 | 2,2 | 2,3 | 1,5 | 2,2 | — |
| 27 | 13,7 | 11,1 | (9,1) | 10,6 | 11,8 | 11,2 | 11,9 | 8,6 |
| 28 | 8,9 | 8,4 | — | 7,7 | 9,0 | 8,6 | 8,9 | — |
| 29 | 3,7 | 3,1 | (2,9) | 3,1 | 3,0 | 3,4 | 3,5 | 3,2 |
| 30 | 5,3 | 4,2 | (3,4) | 4,8 | 4,6 | 5,1 | 3,8 | 4,8 |
| 31 | 7,6 | 8,8 | (6,6) | 8,4 | 7,6 | 8,6 | 7,8 | — |
| 32 | 20,0 | 26,1 | (20,8) | 22,9 | 23,1 | 26,8 | — | 22,6 |
| 33 | 7,4 | — | (6,6) | 6,6 | 6,7 | 6,8 | 7,0 | — |
| 34 | 0 | — | 0 | 0 | 0 | 0 | 0 | 0 |

(  ) Denotes approximate measurement.
* Measured around the curve.
** From notation on a scale drawing in PEM files.
+ Side not recorded.

Measurements of PEM 1520/60: No. 2, 0.61 m; No. 4, 0,31 m; No. 8, 0,58 m; No. 9, 0, 43 m; No. 15, 0,03 m; No. 27, 0,10 m; tip of upper jaw to tooth tip, 0,28 m.

In PEM 1515/56 (Fig. 9) the entire dorsal surface, including the upper jaw, melon, dorsal fin and flukes, was very dark greyish black. The ventral surface was light bluish grey in colour which extended to beyond the anus on the caudal peduncle. Laterally the change from light to dark colouration occurred rather abruptly along a line between the proximal portion of the gape, the eye, the anterior insertion of the flipper and along the belly from a point slightly above the axilla to approximately the mid point of the caudal peduncle. The anterior portion of the ventral surface of the flukes was pale grey but the trailing edge was dark grey. A small patch around the eye and the outer surface of the flipper were intensely black. White oval scars were present over much of the ventral surface from the head to the anus being particularly concentrated around the genital region to the extent that almost all light grey pigment had been obliterated in this area.

Most of the skin of PEM 1518/84 had been flayed off by the rocks during stranding but sufficient remained to indicate that the colour pattern of this animal was very similar to that of PEM 1515/56 in all respects except the colour of the upper jaw which was pale grey proximally and slightly darker grey distally.

PEM 1519/70 had been exposed to the sun for one or two days prior to examination and most of the skin had blackened. However, the beak and anterior part of the head had been protected from the sun by burial in the sand. The upper jaw was dark brownish grey except for a white area on the lateral margin proximally. The lower jaw and throat were pale grey, with a dark brownish grey area along the lip of the lower jaw. White oval scars were present over most of the ventral surface but were particularly concentrated around the genital opening forming an entirely white area. The ventral surface of the flukes was white adjacent to the caudal peduncle, becoming dark grey posteriorly by the progressive concentration of grey flecks on the white background.

Although the colour patterns described by Andrews (1914), Ulmer (1941) and Kasuya and Nishiwaki (1971) were based on specimens which had been dead for longer periods than the present material, the features described by these authors are essentially similar to those described for PEM 1515/56.

The colour pattern of the foetus of PEM 1518/84 differed slightly from the pattern described for PEM 1515/56 illustrated in Fig. 9. The dorsal surfaces of the body, the head and upper jaw, the anterior half of the lip of the lower jaw, the eye patch, the flipper and the flukes were dark greyish brown. The ventral surfaces of the head, body and flukes were white. Between the proximal end of the gape and the ventral edge of the eye patch the demarcation between dark and pale surfaces was distinct. Posterior to the eye patch the dorsal colour paled gradually into the ventral colour along the midlateral level, well above the insertion of the flipper, as far as the insertion of the flukes. The dorsal fin bore a prominent white blaze demarcated sharply from the dark colour of the back along the dorsal fin base. A small white blaze was present above each eye.

The absence of a dark band from the eye to the flipper and a grey ventral surface in this foetus suggests that these features are acquired with age.

The skull of *M. densirostris* has been described in detail by several authors (True, 1910; Harmer, 1924; Ulmer, 1941; Raven, 1942; Besharse, 1971). Comparison of cranial and mandibular measurements of the present material (Tables 25 and 26) with those provided by Besharse (1971) and Kasuya and Nishiwaki (1971) did not indicate any differences in the proportions of the skull in the small samples available from the North Atlantic (four), North Pacific (three) and southern African regions (seven).

It is apparent from Table 25 (measurement nos. 46 and 47) that the right tympanic bulla is consistently longer than the left one in all eight specimens for which both bullae were available. Similar asymmetry is shown by the two specimens recorded by Besharse (1971) from the North Pacific Ocean.

TABLE 25:

Cranial measurements of nine *Mesoplodon densirostris* from southern Africa. Condylobasal lengths (No. 1) and tympanic bullae lengths (Nos. 46, 47) are in millimeters. Other measurements are expressed as percentages of condylobasal length. Measurement numbers are keyed to Table 3.

| Meas. | PEM 1518/84 foetus | PEM 1518/84 ad. ♀ | PEM 1496/74 ad. ♂ | PEM 1519/70 ad. ♀ | PEM 1520/71 imm. ♂ | SAM 36301 ad. ♀ | PEM 1520/60 ad. ♂ | PEM 1515/56 ad. ♀ | PEM 1517/25 ad. ♀ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 377 | 698 | 756 | 769 | 777 | (782) | 787 | 800 | (841) |
| 2 | 57,0 | 63,6 | 62,8 | 62,0 | 65,3 | 61,5 | 63,2 | 62,8 | 59,5 |
| 3 | 72,7 | 81,1 | 78,2 | 79,5 | 79,7 | 79,8 | 79,8 | 76,8 | 75,4 |
| 4 | 76,9 | 84,5 | 81,1 | 84,0 | 84,8 | 82,9 | 85,3 | 80,2 | 79,3 |
| 5 | 45,0 | 52,7 | 49,0 | 50,7 | 54,1 | 52,2 | 54,1 | 51,2 | 53,0 |
| 6 | 54,9 | 68,3 | 62,8 | 62,9 | 62,0 | 58,7 | 66,1 | 62,3 | 63,1 |
| 7 | 85,9 | 91,1 | 94,5 | 93,0 | 93,7 | 91,2 | 90,3 | 89,7 | 89,2 |
| 8 | 64,5 | 74,2 | 76,3 | 75,3 | 76,6 | 74,2 | 75,2 | 72,6 | 72,3 |
| 9 | 72,7 | 77,5 | 80,8 | 78,3 | 80,8 | 77,7 | 79,2 | 76,8 | 74,6 |
| 10 | 89,7 | 93,7 | 95,7 | 94,1 | 95,0 | 93,0 | 93,4 | 92,1 | 90,6 |
| 11 | 76,1 | 83,4 | 85,3 | 84,0 | 84,7 | 83,8 | 84,4 | 81,6 | 80,4 |
| 12 | 51,2 | 59,0 | 57,6 | 58,0 | 59,2 | 56,5 | 60,5 | 56,2 | 54,5 |
| 13 | (16,2) | 13,6 | 15,2 | 14,3 | 13,4 | 13,8 | 13,3 | 13,1 | 14,9 |
| 14 | (15,9) | 12,2 | 13,2 | 11,7 | 12,5 | 11,1 | 12,5 | 12,2 | (11,9) |
| 15 | (2,1) | 3,9 | 5,0 | 3,0 | 3,6 | (2,6) | 3,2 | 4,1 | 3,2 |
| 16 | (5,3) | 7,2 | — | 5,6 | 7,1 | 5,2 | 5,2 | — | 5,1 |
| 17 | 44,6 | 46,4 | 50,2 | 43,8 | 42,7 | 43,7 | 42,9 | 42,5 | 42,0 |
| 18 | 44,3 | 45,1 | — | 43,3 | 41,4 | 42,6 | 41,4 | 41,7 | 40,8 |
| 19 | 37,0 | 42,7 | 47,2 | 42,0 | 43,0 | 41,2 | 41,0 | 39,7 | (39,5) |
| 20 | 37,1 | 33,0 | — | 29,6 | 28,1 | 28,4 | 27,4 | 25,2 | 25,2 |
| 21 | 18,0 | 14,3 | 13,2 | 14,3 | 13,0 | 13,9 | 13,2 | 13,8 | 12,1 |
| 22 | 6,1 | 5,9 | 5,2 | 5,6 | 4,8 | 5,0 | 5,8 | 5,5 | 5,4 |
| 23 | 10,9 | 9,5 | 8,7 | 9,4 | 8,6 | 7,9 | 9,0 | 9,8 | 7,6 |
| 24 | 9,3 | 4,9 | 4,9 | 5,5 | 5,1 | 5,9 | 5,0 | 5,2 | 4,0 |
| 25 | 36,6 | 37,5 | — | 36,4 | 34,1 | 35,0 | 35,3 | 33,3 | 34,1 |
| 26 | (7,2) | 4,7 | 3,4 | 3,4 | 4,6 | 3,1 | (4,1) | 2,8 | 3,0 |
| 27 | (4,5) | 1,3 | 1,2 | 1,2 | 1,3 | 1,3 | 1,1 | 1,3 | 1,2 |
| 28 | (3,7) | 4,0 | 4,4 | 5,3 | 2,7 | 4,7 | 2,8 | 3,5 | 3,3 |
| 29 | 18,8 | 17,6 | 19,3 | 16,3 | 17,5 | 18,0 | 17,3 | 19,0 | 17,0 |
| 30 | 17,0 | 14,2 | 14,2 | 13,3 | 14,4 | 13,8 | 13,5 | 12,8 | 12,4 |
| 31 | 17,8 | 14,5 | 14,6 | 14,2 | 15,1 | 14,5 | 13,6 | 13,3 | 13,0 |
| 32 | 5,0 | 5,4 | 6,4 | 4,4 | 4,5 | 4,9 | 4,7 | 4,9 | 4,3 |
| 33 | 25,7 | 26,6 | 26,3 | 25,0 | 25,9 | 24,3 | 26,8 | 25,2 | 21,2 |
| 34 | (16,2) | 14,9 | 15,7 | 12,7 | 14,3 | (12,0) | 13,6 | 12,2 | 10,9 |
| 35 | 8,2 | 6,6 | 8,4 | 5,7 | 6,0 | 5,8 | 7,5 | 6,1 | 5,6 |
| 36 | 7,7 | 9,3 | 11,9 | 9,2 | 7,7 | 7,8 | 9,7 | 7,5 | 7,6 |
| 37 | 7,7 | 6,0 | 6,1 | 5,5 | 6,2 | 6,6 | 6,2 | 5,5 | 5,8 |
| 38 | 11,1 | 11,7 | 12,3 | 10,1 | 11,2 | 10,5 | 9,9 | 11,3 | 9,2 |
| 39 | 40,6 | 41,8 | 44,0 | 40,6 | 38,1 | 41,2 | 40,9 | 39,3 | 38,0 |
| 40 | 8,0 | 6,9 | 7,5 | 6,8 | 7,2 | 6,5 | 6,9 | 7,2 | 7,4 |
| 41 | 9,0 | 9,7 | 9,6 | 8,6 | 9,7 | 8,3 | 9,3 | 8,4 | 7,7 |
| 42 | 6,1 | 6,2 | 5,5 | 4,7 | 5,3 | 4,6 | 4,6 | 5,4 | 3,7 |
| 43 | 6,1 | 8,2 | 8,9 | 8,8 | 8,8 | 9,1 | 8,6 | 7,8 | 8,9 |
| 44 | (17,2) | (20,1) | 32,0 | 27,3 | 17,6 | (15,3) | — | 28,0 | 18,1 |
| 45 | — | — | — | — | — | (7,7) | — | — | (4,8) |
| 46 | 44 | — | — | 54 | 48 | — | 48 | 51 | 51 |
| 47 | 48,5 | 49 | — | 58 | 52 | — | 52 | 56 | 54 |

( ) denotes approximate measurements.
Tympanic bullae of PEM 1517/11; L, 51 mm; R, 54,5 mm: TNP/B1/75/3; L, 45 mm; R, 49 mm.

TABLE 26:

Mandibular and tooth measurements of 12 *Mesoplodon densirostris* from southern Africa. Mandibular length (No. 1) and tooth measurements (No. 11–14) are in millimetres. Other measurements are expressed as percentages of mandibular length. Measurement numbers are keyed to Table 4.

| Measurement Number | PEM 1518/84 foetus | TNP B/75/3 imm. ♀ | PEM 1517/11 o ? | PEM 1519/69 o ? | PEM 1518/84 ad. ♀ | PEM 1496/74 ad. ♂ | PEM 1517/25 ad. ♀ | PEM 1520/70 imm. ♂ | PEM 1519/70 ad. ♀ | SAM 36301 ad. ♀ | PEM 1515/56 ad. ♀ | PEM 1520/60 ad. ♂ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 308 | — | 427 | — | (621) | 667 | 682 | 689 | 690 | (694) | 697 | 712 |
| 2 | 21,8 | — | 23,4 | — | (26,6) | 24,3 | 27,9 | 28,2 | 27,8 | (27,2) | 25,1 | 32,2 |
| 3 | (21,1) | — | 19,7 | — | — | 18,7 | 19,1 | 18,3 | 18,4 | — | 16,5 | 19,0 |
| 4 | 13,6 | — | 11,9 | — | 14,3 | 26,2 | 13,3 | 13,2 | 13,0 | 12,5 | 12,1 | 21,3 |
| 5 | 12,0 | — | 10,8 | — | 13,7 | 22,5 | 12,5 | 12,3 | 12,2 | 11,1 | 11,2 | 19,1 |
| 6 | 81,8 | — | 78,2 | — | 73,9 | 75,0 | 73,3 | 72,3 | 73,5 | 72,9 | 76,0 | 68,1 |
| 7 | 59,7 | — | 60,9 | — | 58,3 | 59,5 | 54,0 | 55,4 | 56,1 | 57,2 | 56,5 | 53,8 |
| 8 | 8,1 | — | 5,6 | — | 4,0 | 14,0 | 4,5 | 5,1 | 3,5 | 4,3 | 4,4 | 11,2 |
| 9 | (3,6) | — | 1,9 | — | 1,4 | 7,9 | 1,9 | 1,9 | (1,3) | (1,7) | 1,3 | 5,6 |
| 10 | 32,5 | — | 34,9 | — | (38,2) | 38,2 | 42,2 | 41,4 | 41,2 | (39,5) | 40,5 | 37,2 |
| 11 | 36 | 41 | 38 | 50 | 61 | 137+ | 64 | 63 | 68 | — | 62 | 134 |
| 12 | 29 | 31 | 34 | 44 | 45 | 86 | 54 | 55 | 53 | — | 54 | 76 |
| 13 | 13 | 11 | 9,5 | 11,5 | 12 | 49 | 12 | 14 | 11 | — | 12 | 42 |
| 14* | 32 | 34 | 40 | 55 | 67 | 137 | 72 | 64 | 74 | — | 72 | 136 |
| 15** | 1,2 | 2,4 | 3,5 | 13,6 | 20,8 | 489 | 27,2 | 22,9 | 27,6 | — | 27,2 | 326 |

* Length of tooth from tip to posterior corner
** Weight of tooth (g.)
+ Tip worn and rounded
( ) Denotes approximate measurement; 50 mm estimated missing from mandibular tip of PEM 1518/84; 35 mm missing from mandibular tip of SAM 36301

An interesting feature of the series of skulls examined was the consistent presence of a third condyle (*condylus tertius*) on the basioccipital between the two normal condyles. This third condyle was present in nine of the twelve skulls examined; the three exceptions were PEM 1517/11 and TNP/B/75/3 which were too young for adequate ossification to have taken place and PEM 1496/74 in which the basioccipital had been drilled away for mounting purposes. In five skulls the third condyle was well developed with an articulating surface and in four it was small and non-functional. The presence of a third condyle was first noted by Robineau (1968) in a specimen of *M. densirostris* from the Seychelles and in a skull of Sowerbey's beaked whale *M. bidens*. It does not appear to be a rare phenomenon in this genus for Robson and Van Bree (1972) have also recorded its presence in specimens of *M. layardi* and *M. grayi*. Previously this feature was known only amongst the Mammalia from a few primates (Robineau 1968).

The present material supports all but one of Besharse's (1971) conclusions concerning sexual dimorphism in this species. In all five adult females examined in the present study only the proximal 30 mm of the mesorostral canal is filled by bone to the level of the premaxillaries whereas the canal is completely filled for almost its entire length in both adult males. The rostrum is wider and deeper at midlength in both males than in the five females (Table 25, nos. 35, 36) but there is no difference, however, in the length of the rostrum (Table 25, no. 2) as claimed by Besharse (1971). The smaller size of the adult female tooth, alveolus and dental pulpit is apparent from measurements 4, 5, 8, 9 and 11–15 in Table 26.

There seems to be little danger of miss-sexing an adult male on tooth size alone. However, the tooth of the subadult male PEM 1520/71 is almost identical in shape and size to those of the adult females examined in this study (Table 26) and the subadult female illustrated by Besharse (1971). This tooth may be distinguished from those of the females by its open pulp cavity and porous base suggesting continued growth whereas the pulp cavities of the females are entirely closed at their bases which are covered with rugose cement.

The vertebral formulae of four nearly complete skeletons of *M. densirostris* from South Africa are as follows:

PEM 1517/11; C7 T11 L10 Cd18 = 46:
PEM 1519/70; C7 T10 L12 Cd18 (+1) = 47 (+1):
TNP/B/75/3; C7 T10 L10 Cd16 (+3) = 43 (+3):
PEM 1520/71; C7 T9 L10 Cd16 (+1) = 42 (+1).

A single bicipital cervical rib was also found on the right side only in PEM 1520/71. The variation in these formulae is matched by those listed by Raven (1942) for the specimens from Lord Howe Island (C7 T10 L11 Cd17 = 45), Nova Scotia (C7 T11 L8 Cd21 = 47) and New Jersey (C7 T10 L11 Cd18 = 46).

### BIOLOGY

*Age determination*: Teeth from 11 specimens, including the foetus of PEM 1518/84, were available for sectioning.

These teeth include a variety of growth stages which are illustrated by the sections in Plate 3. The tooth of the foetus PEM 1518/84 is a hollow, laterally compressed cone consisting predominantly of dentine which reaches 1 mm in thickness near the apex of the pulp cavity. The apex of the tooth is capped by a layer of granulated, crystalline enamel up to 250 $\mu$ thick and extending down the tooth approximately 7 mm. The remainder of the dentine is covered by a very thin layer of cement about 100 $\mu$ thick, except over the basal quarter of the tooth where the cement is up to 150 $\mu$ thick.

After birth the pulp cavity becomes progressively smaller with age as dentine is deposited on its inner surface in a series of growth layers. Concurrently the tooth is lengthened by the addition of dentine at the base of the tooth. The dentine finally forms an extremely narrow

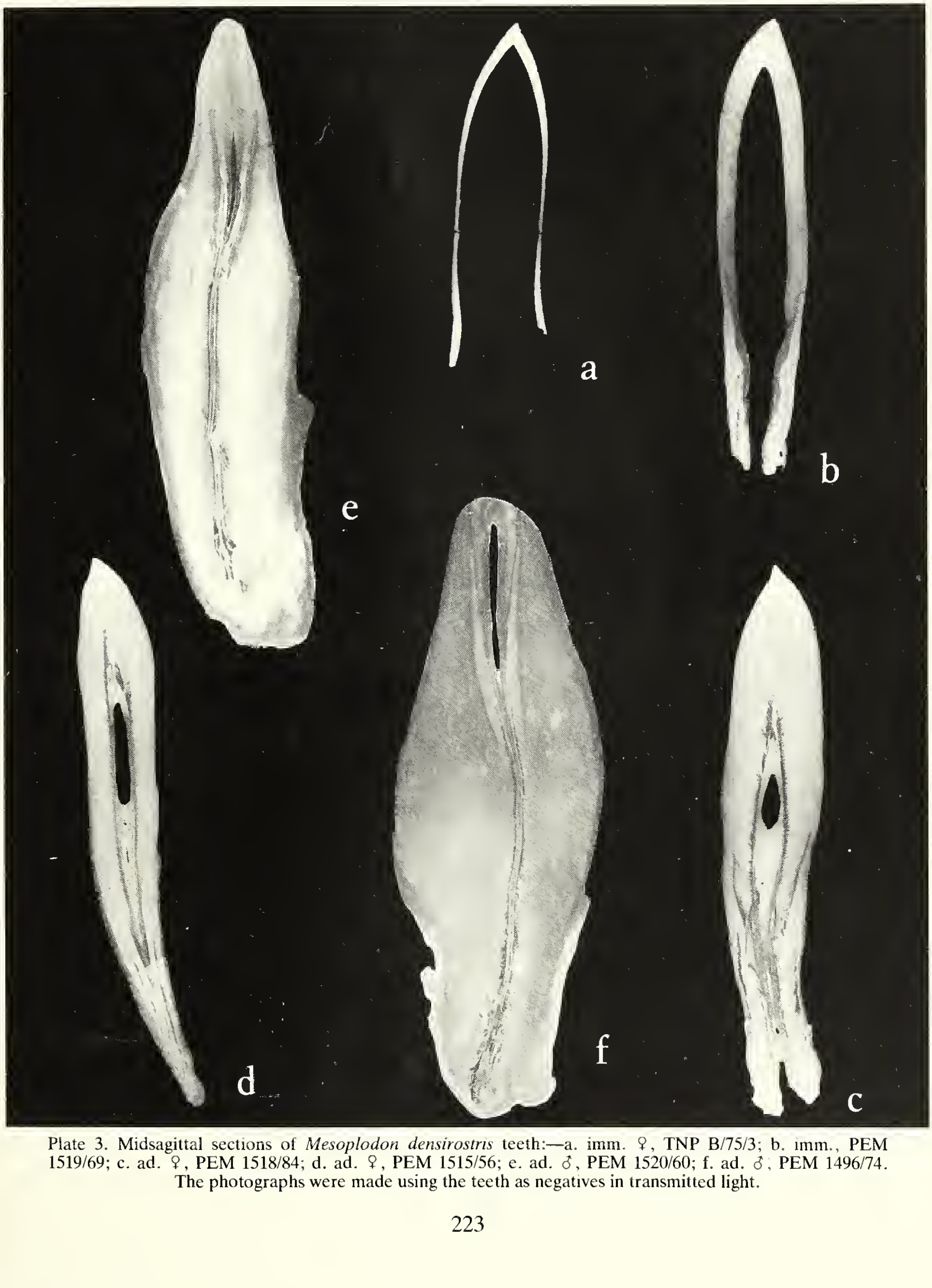


Plate 3. Midsagittal sections of *Mesoplodon densirostris* teeth:—a. imm. ♀, TNP B/75/3; b. imm., PEM 1519/69; c. ad. ♀, PEM 1518/84; d. ad. ♀, PEM 1515/56; e. ad. ♂, PEM 1520/60; f. ad. ♂, PEM 1496/74. The photographs were made using the teeth as negatives in transmitted light.

column throughout the tooth base in which the pulp cavity is partially or completely obliterated (Plate 3d, e, f).

Initially cement is deposited in two distinct zones. The inner zone consists of opaque cement with a chalky, vacuolated appearance in reflected light and is deposited on the base of the tooth. This zone is composed of a narrow internal area adjacent to the dentine column and a wider external area separated by a strip of transparent, non-calcified tissue. The outer zone of cement is translucent and laminated and is deposited on the lateral surfaces of the tooth base (Plate 3b, c). In adult females the teeth do not appear to develop beyond this stage and finally the outer translucent cement covers the base of the tooth (Plate 3d).

In the adult male (Plate 3e, f) the tooth is elongated by the growth of the dentine column and the inner zone of the cement. Deposition of translucent cement onto the outer zone appears to cease and it is covered by numerous layers of opaque, chalky cement which is indistinguishable from that of the inner zone. The outer layers of cement surrounding the tooth are comparatively translucent but this region is apparently not a separate entity as some layers in it are confluent with those of the opaque region. A similar situation is described by Boyde (1968) for *M. layardi* teeth in which the opague and translucent cement are termed vaso-cement and cement respectively.

Counts of the number of postnatal dentine layers are provided in Table 27. It is clear from these counts that these layers will only be useful in ageing young animals. Dentine deposition apparently ceases altogether before the pulp cavity is completely filled, since animals known to be physically mature have partially unfilled pulp cavities.

The number of layers in the outer cement zone and in the dentine were the same in the subadult male PEM 1520/71 (seven) and the adult male PEM 1520/60 (eight) indicating that they are deposited at the same rate. This suggests that deposition of the opaque cement external to the outer cement zone probably does not take place until dentine deposition has ceased. This opaque cement is laminated in structure, but the layers are variable in thickness and difficult to count and thus of little use in age determination in the present study.

*Growth and development*: The length at birth in *M. densirostris* is not known. The foetus of PEM 1518/84 was 1,90 m in length and considered to be near term. The thickness of the prenatal dentine in this foetus was about 1 mm and very close to that of TNP/b/75/3 (1 mm), PEM 1517/11 (1,2 mm) and PEM 1519/69 (1 mm), confirming that the foetus was close to term.

TABLE 27:

Numbers of postnatal dentine growth layers in the teeth of ten *Mesoplodon densirostris* from southern Africa.

| Catalogue Number | Total length (mm) | Sex | Number of dentine layers | Remarks |
|---|---|---|---|---|
| TNP/B/75/3 | 2 610 | ♀ | <1 | Postnatal dentine 150 μ thick. |
| PEM 1517/11 | (2 600) | – | <1 | Postnatal dentine 350 μ thick. |
| PEM 1519/69 | (3 850) | – | 2 | |
| PEM 1520/71 | 4 150 | ♂ | 7 | Physically immature. |
| PEM 1519/70 | 4 560 | ♀ | 9 | Physically mature. |
| PEM 1517/25 | — | ♀ | 8 or 9 | |
| PEM 1515/56 | 4 710 | ♀ | 10 or 11 | Physically mature. |
| PEM 1518/84 | 4 330 | ♀ | 12 or 13 | Physically mature. |
| PEM 1520/60 | — | ♂ | c.8 | Teeth erupted, massive. |
| PEM 1496/74 | 4 725 | ♂ | 6+ | Physically mature, teeth erupted. Tip of tooth worn away. |

( ) denotes approximate measurement.

The lengths of few *M. densirostris*, known to be adult, have been measured. In males there is some evidence that tooth eruption and attainment of physical maturity occur at approximately the same time for the adult males recorded by Raven (1942) (4,39 m) and PEM 1496/74 (4,725 m) both had erupted teeth and fused epiphyses whereas the epiphyses of the specimen from New Jersey (4,39 m) were only partially fused with no indication that the teeth had erupted (Andrews, 1914; Ulmer 1941). On this basis the 4,12 m male recorded by Guiler (1966) was mature. The state of maturity of the male recorded by Michel and Van Bree (1976) (4,29 m) is not certain. PEM 1520/71 (4,15 m) was physically immature.

The three adult females known to be physically mature were 4,71 m, 4,33 m and 4,56 m in length (Table 23). Comparison of these few data with those for males do not suggest that this species is sexually dimorphic with respect to length.

The mass of the 2,61m juvenile female TNP/B/75/3 was 184,4 kg entire and that of the 1,90 m foetus, after having been frozen for several months was 59,5 kg entire.

The mass of the adult female PEM 1519/70, in pieces, was 939,5 kg. The masses of body portions expressed as percentages of body mass (corrected for 10 per cent loss of body fluids during dissection) are—blubber, 21,1; meat, 47,9; the head, 5,1; heart, lungs and trachea, 1,6; heart, 0,29; liver 1,1. The intestine of this whale was 19,0 m in length. The subadult male SAM 38220, 3,95 m in length, in pieces, weighed 637,4 kg (Dr P. Best, *pers. comm.*).

Raven (1942) recorded that the 4,39 m long specimen stranded in New Jersey was thin and, in pieces, weighed 809 kg.

*Reproduction:* The available data on reproduction in this species are very limited.

The ovaries of three physically mature females and those of the foetus of PEM 1518/84 were examined. Details of these are provided in Table 28.

The length at sexual maturity in females is not known. The three females of known length in the present study were all physically mature and exceeded 4,3 m in length. The only other specimen of which the ovaries have been examined was a sexually immature animal 3,56 m in length (Kasuya and Nishiwaki, 1971).

Table 28:

Ovarian data from four *Mesoplodon densirostris* from the SE coast of southern Africa.

| Catalogue Number | Total length (mm) | Ovarian | | Corpora lutea diam. (mm) | Corpora albicantia diam. (mm) and index | Remarks |
|---|---|---|---|---|---|---|
| | | Dimensions (mm) | Mass (g) | | | |
| PEM 1518/84 | 1 900 | 35 × 22 × 10 | 4,9 | 0 | 0 | Ovary surface rugose. |
| (foetus) | | 39 × 15 × 18 | 4,9 | 0 | 0 | Ovary surface rugose. |
| PEM 1518/84 | 4 330 | 73 × 33 × 12(R) | 28,5 | 34 | 8(96);<br>7(84);<br>5(80) | Corpus luteum mass 11,7 g. Small cavity filled with tertiary liquor folliculi. No surface scars. |
| | | 53 × 30 × 15(L) | 12,8 | 0 | 0 | Ovary surface smooth, several small follicles up to 1 mm. |
| PEM 1519/70 | 4 560 | 64 × 37 × 20(R) | 25,1 | 0 | 8(250) | Surface of ovaries smooth, no surface scars. Several follicles up to 6 mm in diameter. |
| | | 57 × 32 × 20(L) | 20,6 | 0 | 0 | |
| PEM 1515/56 | 4 710 | 62 × 27 × 12(R) | 14,2 | 0 | 8(392);<br>6(36);<br>5(45);<br>4(36) | Follicle 12 mm in diameter, and several up to 1 mm. |
| | | 69 × 30 × 14(L) | 15,9 | 0 | 5(125);<br>5(30) | Numerous follicles up to 1 mm. Few atretic follicles. |

The low numbers of corpora found in the ovaries of these physically mature females is interesting as a similar situation was found in the two *M. mirus* examined in this study. It is possible that either physical maturity is attained soon after sexual maturity is reached or that ovulation rates are naturally low in these animals. The presence of a foetus in PEM 1518/84 and well developed follicles in the other two females suggest that they were all reproductively active animals at the time of death.

The mammary gland of PEM 1515/56 contained some milk, though the absence of any large corpus in the ovaries indicates a late stage of lactation. The gland measured 970 × 50 × 13 mm and tapered anteriorly. The inactive gland of PEM 1519/70 measured 580 × 50 × 18 mm.

It is likely that the near term foetus of PEM 1518/84 would have been born within the next month or two (i.e. March or April).

The right testis of the 4,15 m subadult male PEM 1520/71 measured 80 × 25 mm but was too decomposed to examine histologically. The testes of the 3,95 m male SAM 38220 weighed 27 g and 15 g. These measurements and weights are not much greater than those of an immature *M. mirus* (present study) and are comparable to those of the testes in immature delphinids (Harrison *et al.*, 1972), suggesting that both of these male *M. densirostris* were sexually immature.

*Food and feeding:* There is no published information on the food of this species, apart from a note by Leatherwood *et al.* (1976) that squids have been recorded in the stomachs of stranded animals.

Four of the five stomachs (PEM 1515/56, 1519/70, 1520/71, TNP/B/75/3) examined in the present study were entirely empty. The stomach of PEM 1518/84 contained 21 fish otoliths identified as species of the genera *Cepola*? (1), *Scopelogadus* (1) and *Lampanyctus* (19).

### Distribution and migration

*M. densirostris* is a widely distributed species, recorded from the North Atlantic, South Atlantic and North Pacific Oceans, Australasian seas, and the Indian Ocean. To the distribution pattern mapped by McCann (1964b) may be added the additional records from Florida (Caldwell and Caldwell, 1971a), New Guinea (Arbocco, 1968/69), Mauritius (Michel and van Bree, (1976), Taiwan (Kasuya and Nishiwaki, 1971) and from the present study.

Moore (1966) noted that the distribution of this species is essentially tropical, with the exception of the North American strandings, and suggested that the warm, north-flowing Gulf Stream accounted for the extension of distribution beyond the tropics as far north as 45° N on the eastern coast of North America. At that time Moore knew only of three southern African records. However, since 1970 the number of southern African records has risen to 15 (of the 39 records known worldwide) indicating that *M. densirostris* occurs relatively frequently in this region. It is suggested that the southern African situation is similar to that off North America and that *M. densirostris* either inhabits the waters of the Agulhas Current which constitutes an extension south-westwards of tropical waters or that occasional specimens are transported inadvertently from tropical waters by the current to this region.

The 11 southern African specimens recorded for which dates are available stranded in February (2), March (1), April (1), May (2), June (1), July (1), August (1), August/September (1) and December (1). These dates indicate that *M. densirostris* is present (or can occur) in these waters throughout the year and that there is no suggestion of seasonal migratory behaviour. The situation in the North Atlantic and North Pacific appears similar. The five dated North Atlantic specimens stranded between 40° N–45° N in the months of January, February, May, August and December. Four dated North Pacific specimens stranded between 23° N–28° N in the months of February, April (2) and August.

## Genus *ZIPHIUS* Cuvier, 1823

*Recherches sur les ossements fossiles*, 5: 350–352; type species, *Ziphius cavirostris* Cuvier, by original designation.

The monotypic genus *Ziphius* is characterized by the following features. The anterior faces of the premaxillae, posterior to the superior nares, are directed antero-mesially. The combined breadth of the nasal bones is greatest anteriorly, where the right nasal is not in contact with the right premaxillary. Further, the nasals project anteriorly beyond the dorsal ends of the premaxillae, when the skull is viewed laterally with the long axis of the beak horizontal. A pair of well defined alveoli at the apex of the mandible support teeth which are spindle-shaped and circular in cross-section (Fig. 5). The teeth erupt in adult males but not in females and are broader in males (width more than 40 per cent of length) than in females (width less than 40 per cent of length).

### *Ziphius cavirostris* Cuvier, 1823

### Cuvier's Beaked Whale

*Ziphius cavirostris Cuvier*, 1823: 350 (holotype, fossilized skull, Museum National d'Histoire Naturelle, Paris; type locality, between Fos and the mouth of the Galégeon, France); Sclater, 1901: 192; FitzSimons, 1920: 218; Roberts, 1951: 222; Ellerman, Morrison-Scott and Hayman, 1953: 327; Barnard, 1954: 18; Best, 1971: 3; Ross and Tietz, 1972: 1 (new records).
*Ziphius indicus* van Beneden, 1863: 23.
*Hyperoodon capensis* Gray, 1865a: 359.
*Petrorhynchus capensis* Gray, 1865b: 528.
*Petrorhynchus indicus* Gray, 1866: 346.

RECORDS AND MATERIAL

Data for five specimens recorded from the SE coast of southern Africa are provided in Table 29, and localities are mapped in Fig. 30. Ross and Tietz (1972) have reported on two additional specimens from Cape Cross, South West Africa and Still Bay, 80 km W of Mossel Bay. Skeletal material from the two SAM specimens in Table 29 was not examined for this study.

TABLE 29:

Records and material of *Ziphius cavirostris* on the SE coast of southern Africa.

| Catalogue Number | Sex | Total Length (mm) | CBL (mm) | Date | Locality | Comments |
|---|---|---|---|---|---|---|
| PEM 1514/08 | ♀ | 5 790 | *c.*860 | 07.02.66 | near Seaview | Skull, mandibles and teeth in PEM (Ross and Tietz, 1972). |
| ELM 857 | ♂ | 5 970 | 910 | 06.06.67 | Gulu River Mouth | Skull, mandibles and tooth in PEM (Ross and Tietz, 1972). |
| SAM 36836 | ♂ | 5 750 | — | 13.03.73 | 29° 50′S, 32° 59′E | Skull, mandibles and teeth in SAM. Harpooned at sea by Union Whaling Co. |
| SAM 36837 | ♂ | 5 690 | — | 13.07.73 | 29°15′S, 32°59′E | Skull, mandibles and teeth in SAM. One of five whales found dead at sea. |
| PEM 1520/01 | ♂ | 5 880 | 924 | 23.03.76 | 1 m E. Fish River Point | Skull, mandibles and teeth in PEM. |

### Specific status and characters

*Ziphius cavirostris* is presently accepted as a single, widely-distributed species (Norman and Fraser, 1948), though prior to the studies of Turner (1872) and Flower (1876), specimens of *Z. cavirostris* had been described under 19 specific names in 7 genera (Hershkovitz, 1966). A large number of skulls of this species, from most parts of its distribution, is preserved in the world's museums, and a careful study of this material should indicate whether populations can be distinguished on skeletal morphology.

Diagnostic characters for the species are given in the generic description above.

### Description

An adult male, 5,88 m in length (PEM 1520/01) is illustrated in Fig. 10.

This species is robust in form. The melon slopes gently anteriorly, merging imperceptibly into the beak which is short and broad at its base. The gape is relatively short (about 5–7 per cent body length) and slightly sigmoid in shape in lateral view. The distance from the tip of the beak to the blowhole is 10–12 per cent body length (Norman and Fraser, 1948); this measurement is 9,4 per cent in SAM 36837 and 10,7 per cent in PEM 1520/01. The flippers and dorsal fin are small and the latter is placed slightly more than two thirds of body length from the tip of the snout. External measurements for SAM 36837 and PEM 1520/01 are given in Table 30.

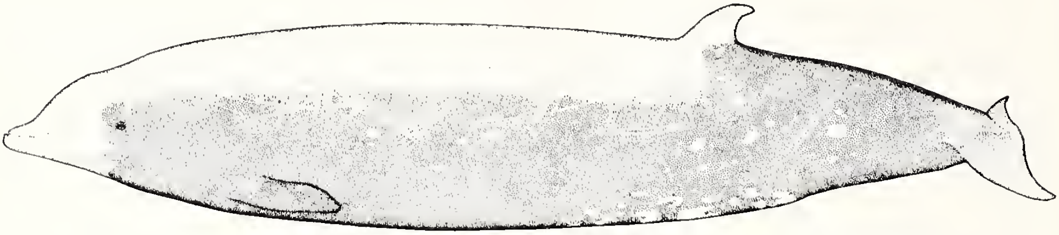


Fig. 10. Adult male *Ziphius cavirostris*, 5,88 m in length, from the eastern Cape (PEM 1520/01).

Several authors have described the colour pattern of *Z. cavirostris* as variable (Norman and Fraser, 1948; Tomilin, 1957; Gaskin, 1968a) or as inadequately known (Mitchell and Houck, 1967). Ross *et al.* (in prep.), however, show that adult animals of both sexes have a distinctive colour pattern as shown in Fig. 10. The limited information available suggests that juveniles may have a different colour pattern. A 3,66 m animal described by Burmeister (1866, *in* Tomilin, 1957) was light grey with a yellowish tinge in colour, but much darker dorsally and lighter ventrally. The flippers and fin were almost black and the tail flukes had a white patch on their ventral surface. Descriptions of larger, immature specimens suggest that as these mature the belly darkens, the head becomes greyish in colour and white oval scars and parallel streaks appear on the skin (Ross *et al.*, in prep.).

Finally the adult pattern appears (Fig. 10), in which the head and dorsal surface as far as the dorsal fin turn white and the ventral surface, sides and the rest of the back becomes dark bluish grey or black. The cause of the white oval scars is unknown bu the parallel white streaks are through to be tooth marks inflicted during intraspecific interactions.

The skull of *Z. cavirostris* has been described in detail by Kernan (1918). Mitchell and Houck (1967) described variations in skull features related to age and sex in a small sample from California and four skulls from southern Africa were examined for similar features by Ross and Tietz (1972). Adult male *Z. cavirostris* develop a massive mesorostral ossification and

TABLE 30:

External measurements to the nearest 5 mm (except numbers 16, 18 and 23) of two *Ziphius cavirostris* (PEM 1520/01, SAM 36837) and one *Hyperoodon planifrons* (PEM 1520/30) from the SE coast of southern Africa. Measurement numbers are keyed to Table 3.

| Measurement Numbers | PEM 1520/01 ♂ | SAM 36837 ♂ | PEM 1520/30 ♂ |
|---|---|---|---|
| 1 | 5 880 | 5 690 | 2 910 |
| 2 | 650 | 700 | 430 |
| 4 | 360 | 490 | 260 |
| 5 | 770 | 975 | — |
| 6 | 140 | 145 | — |
| 7 | 340 | 280 | 190 |
| 8 | 570 | 485 | 270* |
| 9 | 630 | 535 | 410 |
| 10 | 1 300 | 1 195 | 710 |
| 11 | 3 850 | 3 660 | 1 820 |
| 12 | 4 250 | 3 960 | 2 020 |
| 13 | — | 2 665 | 1 450 |
| 14 | — | 3 555 | 1 780 |
| 15 | — | 3 940 | 2 030 |
| 16 | — | 45 | 12 |
| 17 | — | 485 | 390 |
| 18a | — | 100 | 26 |
| b | — | 45 | 22 |
| c | — | 75 | 20 |
| 19a | 270 | 280 | 250 |
| b | 270 | 280 | 250 |
| 20 | — | — | 1 320 |
| 21 | — | — | 1 420 |
| 22 | — | 2 030 | 1 060 |
| 23 | — | 44 | 27 |
| 24a | — | 15 | 35 |
| b | — | 50 | 35 |
| 25a | — | 240 | 170 |
| b | — | 140 | 80 |
| 26 | 130 | 150 | 85 |
| 27 | 650 | 635 | 290 |
| 28 | 500 | 485 | 175 |
| 29 | 200 | 190 | 80 |
| 30 | (280) | (305) | 130 |
| 31 | 380 | 405 | 210 |
| 32 | 1 740 | 1 575 | 620 |
| 33 | 510 | 440 | 205 |

( ) denotes approximate measurement.
* on right side; 230 mm on left.

deep spiracular basin (True, 1910; Fraser, 1942) as well as teeth of large diameter. These features are lacking in adult females.

In PEM 1520/01 the spiracular basin is extremely deep, reabsorption of the bone in this region is so extensive that only the dorsal edges of the premaxillary bones remain at the level of the base of the rostrum and the mesorostral ossification is extensively eroded laterally forming and overhanging, dorsal shelf of bone. The teeth in this specimen are decayed at their roots and extensively worn on ther tips suggesting old age (Plate 2g). The left mandibular alveolus is reduced to 8 mm in depth while the right alveolus is completely filled, and provided very little support for the teeth in life. The outer surface of each tooth was chalky in texture and flaked off easily during drying. These teeth were subsequently stored in 70 per cent alcohol.

A single vestigial tooth protruded through the gum in the left upper jaw of the physically mature male SAM 36837. Cranial and mandibular measurements of PEM 1514/08 and ELM 857 were given by Ross and Tietz (1972). Measurements of PEM 1520/01 are provided in Tables 31 and 32. The left tympanic bulla of PEM 1514/08 is 55 mm in length. The lengths of the bullae of PEM 1520/01 are 55 mm (left) and 58 mm (right). The asymmetry in the lengths of the left and right bullae of this skull supports Omura's (1972) observation that the right bulla of nine *Z. cavirostris* was consistently longer than the left bulla. The degree of asymmetry in this species is remarkably similar to that of *Mesoplodon densirostris* in which the right bulla is also the longer of two (present study). The significance of such asymmetry is not clear at all, though presumably it is related to auditory function.

True (1910) gives the vertebral formulae of four complete columns as C7 T9–10 L9–11 Cd19–20 = 46. The vertebral formulae of seven skeletons from the coast of Japan were C7 T9–10 L10–11 Cd20–21 = 46–47 (Omura, 1972). True (1910) gives the vertebral formula of the Argentinian specimen described by Burmeister (1866) as C7 T10 L10 Cd22 = 49 but suggests that two or three additional terminal vertebrae have been added to the figures to make the column appear to taper evenly. The vertebral formula of a South Australian specimen was C7 T10 L10 Cd19 = 46 (Aitken, 1971).

## BIOLOGY

*Age determination:* Teeth from three animals were sectioned (PEM 1514/08, 1520/01 and ELM 857) and are illustrated in Plate 2.

Growth layers in the female PEM 1514/08 (Plate 2e) are very clear in both dentine and cement. A total of 28 dentine layers can be counted to the centre of the tooth. In the cement about 30 layers are clearly visible.

The elongated dentine column in the male ELM 857 (Plate 2f) contains a few poorly defined layers near the root of the tooth but the majority of the dentine appears to lack clear layers. About two-thirds of the mass of the tooth consists of cement, much of which has the same chalky appearance in reflected light as that recorded for the teeth of male *M. densirostris* (present study); in this respect the teeth of male *Ziphius* appear to have an intermediate type of growth pattern between that of *M. mirus* in which dentine contributes much of the tooth mass and that of *M. densirostris* in which dentine contributes very little of the tooth mass. The cement of ELM 857 was laminated and 24 or 25 of these layers could be counted.

Very little remains of the teeth of PEM 1520/01 as a result of excessive apical wear and decay at the root. However, in a polished half-section of the remaining portion (Plate 2 g) at least ten dentine layers and a minimum of 36 cement layers are visible in reflected light.

No conclusions can be drawn from the present material either concerning the rate of formation of these layers or whether those in the dentine and cement are formed at the same rate. However, the similarity in the number of layers in PEM 1514/08 suggests that this may be true, at least up to the point when the pulp cavity becomes obliterated.

*Growth and development:* The length at birth is uncertain. However, Tomilin (1957) recorded a fully developed foetus 2,67 m in length from Bering Island, and Omura *et al.* (1955) recorded a free swimming male 3,05 m in length. Deraniyagala (1945) recorded a 2,17 m animal captured in a seine net off Ceylon.

Total lengths of 183 male and 91 female *Z. cavirostris* caught commercially off the coast of Japan from 1948–1952 and 1965–1970 were provided by Omura *et al.* (1955) and Nishiwaki and Oguro (1972). The greatest length in the combined samples was 7,0 m (23 feet) for both males and females. The average length of 123 sexually mature males longer than 5,5 m (18

TABLE 31:

Cranial measurements in mm of *Mesoplodon grayi, Ziphius cavirostris* and *Berardius arnouxi* in the Port Elizabeth Museum. Measurement numbers are keyed to Table 3.

| Measurement Number | *M. grayi* PEM 5 | *Z. cavirostris* PEM 1520/01 | *B. arnouxi* PEM 1496/67 |
|---|---|---|---|
| 1 | 802 | 924 | 1253 |
| 2 | 545 | 529 | 782 |
| 3 | 668 | 714 | 981 |
| 4 | 690 | 745 | 1030 |
| 5 | 487 | 410 | 669 |
| 6 | 567 | 468 | 715 |
| 7 | 753 | 804 | 1164 |
| 8 | 611 | 628 | 926 |
| 9 | 661 | 658 | 1066 |
| 10 | 765 | 824 | 1196 |
| 11 | 684 | 694 | 1055 |
| 12 | 529 | 466 | 699 |
| 13 | 108 | 148 | 225 |
| 14 | 97 | 118 | 135 |
| 15 | 52 | 147 | 112 |
| 16 | (46) | 138 | 113 |
| 17 | 292 | 553 | — |
| 18 | 295 | 533 | 708 |
| 19 | 285 | 529 | 685 |
| 20 | 193 | 320 | 381 |
| 21 | 110 | 167 | 198 |
| 22 | (47) | 63 | 73 |
| 23 | 72 | 117 | 142 |
| 24 | — | 59 | 80 |
| 25 | (283) | 433 | 534 |
| 26 | 34 | 71 | 125 |
| 27 | 11 | 54 | 88 |
| 28 | –23 | 0 | –18 |
| 29 | 124 | 220 | 207 |
| 30 | 97 | 220 | 190 |
| 31 | 115 | 220 | 232 |
| 32 | 25 | 88 | 110 |
| 33 | 180 | 325 | 442 |
| 34 | — | (245) | — |
| 35 | 32 | 119 | (192) |
| 36 | 37 | 104 | 102 |
| 37 | 44 | 103 | (95) |
| 38 | (78) | 138 | (165) |
| 39 | 279 | 365 | 550 |
| 40 | 58 | 75 | 128 |
| 41 | 59 | — | 183 |
| 42 | 32 | 155 | 106 |
| 43 | 40 | 66 | (150) |
| 44 | 178 | 225 | (350) |
| 45 | 0 | 0 | 0 |
| 46 | 50 | — | — |
| 47 | 54 | 54 | — |

( ) denotes approximate measurement.

Table 32:

Mandibular measurements in mm of *Mesoplodon grayi*, *Ziphius cavirostris* and *Berardius arnouxi* in the Port Elizabeth Museum. Measurement numbers are keyed to Table 4.

| Measurement Number | *M. grayi* PEM 5 | *Z. cavirostris* PEM 1520/01 | *B. arnouxi* PEM 1496/67 |
|---|---|---|---|
| 1 | 708 | 832 | 1 171 |
| 2 | 243 | 168 | 240 |
| 3 | 110 | 157 | 204 |
| 4 | 40 | 32 | 76 (92) |
| 5 | 47 | 32 | 52 (90) |
| 6 | 474 | 675 | 921 |
| 7 | 445 | 797 | 1 090 (1 021) |
| 8 | 76 | 32 | 71 (38) |
| 9 | — | 21 | 33 (20) |
| 10 | 181 | 10 | 13 (116) |
| 11 | — | — | 76+ (56) |
| 12 | — | — | 61 (29) |
| 13 | — | — | 28 (16) |

( ) refers to measurement of the posterior tooth or alveolus of *B. arnouxi*.

feet) was 6,07 m (19,9 feet) and that of 71 females was 5,99 m (19,7 feet). These measurements indicate that *Z. cavirostris* is not sexually dimorphic with respect to body length.

Only one of six southern African *Z. cavirostris* recorded to date was more than 6,0 m in length (Still Bay, physically mature female 6,10 m; Ross and Tietz, 1972). SAM 36837 (5,69 m) was physically mature as the epiphyses of the thoracic vertebrae were fused to their centra. The numbers of laminations in the teeth of PEM 1514/08, 1520/01 and ELM 857, with total lengths of 5,79 m, 5,88 m and 5,97 m respectively, suggest that these animals were of an age when relatively little additional growth would have occurred.

The evidence from this limited sample suggests that *Z. cavirostris* in southern African waters may be slightly shorter in length than those in Japanese waters.

The adult male SAM 36837 weighed 2450 kg entire on a 9 000 kg scale.

*Reproduction:* The material examined in the present study provides little additional information on reproduction.

Omura *et al.* (1955) and Nishiwaki and Oguro (1972) suggest that male and female *Z. cavirostris* reach sexual maturity at about 5,5 m in length (18 feet). Duguy (1976) reported on a pregnant female 5,42 m in length (17,75 feet) that stranded on the French coast. The combined testis masses of a male 5,49 m in length was 8,3 kg, and that of a 5,85 m male was 7,5 kg (Omura *et al.*, 1955); these whales were considered to be sexually mature.

The testes of SAM 36837 were 20 cm in length and weighed 160 g and 150 g each. In PEM 1520/01 the testes were 22 cm and 24 cm in length. Despite considerable decomposition in the testes which caused bloating, the testes in these two males were surprisingly small compared to those examined by Omura *et al.* (1955). SAM 36837 was physically mature and hence certainly sexually mature, while PEM 1520/01 showed evidence of being an old animal. It is possible that the testes regress in size with the onset of old age in this species.

The lengths of foetuses recorded in August (30, 97 and 213 cm), September (171, 267 cm) and October (43 cm) in the North Pacific (Omura *et al.*, 1955; Tomilin, 1957) suggest that the breeding and calving seasons are spread over several months. Caldwell *et al.* (1971a) reported on a female with a near-term foetus taken off St. Vincent, Lesser Antilles, in late summer, 1967.

*Food and feeding:* There is little information on the feeding habits of *Z. cavirostris*. Nishiwaki and Oguro (1972) recorded deep-sea fish and squids in the stomachs of animals caught off the Japanese coast. An immature female was caught on a tuna long line baited with Saury Pike (Omura *et al.*, 1955). Tomilin (1957) and Mitchell and Houck (1967) recorded specimens with numerous squid beaks in their stomachs.

A few squid beaks and eye lenses were collected from the last five pyloric compartments of the stomach and from the duodenum of SAM 36837. The identifications of nine lower beaks are provided in Table 33.

The stomach of PEM 1520/01 contained 84 upper and 101 lower beaks of squids, 46 morid otoliths identified as a species of *Antimora*, unidentified fragments of crustaceans (possibly *Gnathophausia*), a plastic bottle top and cap, two pieces of pumice and a large seed. Two parasitic copepods identified as *Lophoura elongata* (Kensley and Grindley, 1973) were also found in this stomach and are presumed to have originated from fish eaten by this whale.

The identifications of the 101 lower beaks of squids are listed in Table 33. In order of numerical importance, cranchiid squids form approximately 45 per cent of the beaks in this stomach (28 per cent excluding cranchiid types 1 and 2 the familial affinities of which are uncertain), followed by chiroteuthids (18 per cent), octopoteuthids (12 per cent) and onychoteuthids

TABLE 33:

Numbers of lower beaks of squids from two stomachs of *Ziphius cavirostris* from the SE coast of southern Africa.

| Squid | PEM 1520/01 | SAM 36837 |
|---|---|---|
| CRANCHIIDAE | | |
| *Taonius* | 13 | 2 |
| *Pyrgopsis* | 5 | — |
| *Galiteuthis* | 4 | — |
| *Mesonychoteuthis* | 3 | — |
| *Phasmatopsis* | 3 | 2 |
| Type 1 | 12 | — |
| Type 2 | 5 | — |
| HISTIOTEUTHIDAE | | |
| Type 2 | 1 | — |
| Type 4 | 2 | 1 |
| OCTOPOTEUTHIDAE | | |
| *Octopoteuthis* | 10 | 2 |
| *Taningia* | 2 | — |
| CHIROTEUTHIDAE | | |
| Type 1 | 3 | 1 |
| Type 2 | 1 | — |
| Type 3 | 14 | — |
| ONYCHOTEUTHIDAE | | |
| *Moroteuthis* | 9 | 1* |
| LYCOTEUTHIDAE | | |
| *Lycoteuthis* | 1 | — |
| GONATIDAE | | |
| *Gonatus* | 1 | — |
| OMMASTREPHIDAE | 1 | — |
| UNIDENTIFIED | 11 | — |

* This beak is not identical to *Moroteuthis* beaks in PEM 1520/01.

(9 per cent). The remaining families form 6 per cent of the total and unidentified beaks form 11 per cent of the total. All of these families of squids are essentially oceanic in distribution (Clarke, 1966). The catch positions on the Japanese coast of *Z. cavirostris* with stomach contents are concentrated over the 1 000 m depth contour. Those whales containing deep sea fish were caught in water over 1 000 m deep whereas those containing squids were often over shallower water (Nishiwaki and Oguro, 1972).

*Parasites:* Nematodes collected from the stomach of PEM 1520/01 were identified as *Anisakis* sp.

In SAM 36837 cestode cysts were noted in the blubber, a few nematodes were collected from the stomach and numerous nematodes were found in the kidneys.

### Distribution and migration

*Z. cavirostris* is widely distributed in the temperate and tropical seas of the world. Moore (1963a) mapped the distribution of known records and commented that in a general way this distribution matched that of interested observers. At that time the only positive records of *Z. cavirostris* in the entire Indian Ocean were from Ceylon (Deraniyagala, 1945). This species has subsequently been recorded from the Comores Islands (Robineau, 1975), Aldabra Island (Dr J. D. Taylor, *in litt.*, 20 October 1974) and tentatively from Pakistan (Pilleri and Gihr, 1972a).

Southern African records extend from Cape Cross, South West Africa into the south-western Indian Ocean (Ross and Tietz, 1972; present study). Records from the south east coast, mapped in Fig. 30, include a sight record of an adult seen by the author and other observers on 23 January 1975 at 173°, 372 km from Cape St. Blaize, Mossel Bay (IOS, 1975). The three records of animals seen or collected at sea support the data mapped by Nishiwaki and Oguro (1972) which indicate that *Z. cavirostris* generally occurs in water of 1 000 m or more in depth.

The months of occurrence are known for seven southern African records: January, (1); February, (1); March, (2); June (1); July (2) (Ross and Tietz, 1972; present study). The absence of any records for the spring and early summer months may indicate that *Z. cavirostris* moves away from this region in these months, though the number of records is at present very small. Nishiwaki and Oguro (1972) recorded catches of this species off Japan in all months of the year, but suggested that high catches of adult males in February—May and August—December were related to migratory movements. There was no evidence of seasonality in stranding dates in New Zealand waters (Gaskin, 1972) or on the west cost of North America (Mitchell, 1968).

## Genus *BERARDIUS* Duvernoy, 1851

*Ann. Sci. Nat.*, Paris, (3), Zool. 15: 52, 68; type species, *Berardius arnuxii* Duvernoy, 1851 by original designation.

The genus *Berardius* is characterized by a number of skeletal features. The possession of two pairs of mandibular teeth, the larger pair situated near the apex and the smaller pair situated more proximally, distinguishes *Berardius* from all other cetacean genera (Fig. 5). The suture between the maxillary and premaxillary bones remains unfused for at least 80 per cent of its length on the dorsal surface of the skull. When the skull is upright and the long axis of the rostrum is horizontal, in lateral view the dorsal profile of the premaxillary bones never approaches an angle perpendicular to the long axis of the rostrum. In posterior view with the skull in the same position, the dorsal surfaces of the nasal and premaxillary bones rise above the supraoccipital bone. *Tasmacetus* is similar to *Berardius* in this last character but is distinguished from *Berardius* by the other three features. The skull of *Berardius* is slightly asymmetrical bilaterally.

Two species of *Berardius* are currently recognized. *B. arnouxi* Duvernoy occurs in the Southern Hemisphere whereas *B. bairdi* Stejneger is known from the North Pacific Ocean.

## ***Berardius arnouxi*** Duvernoy, 1851
## Arnoux's Beaked Whale

*Berardius arnuxii* Duvernoy, 1851: 52 (holotype, skull, Museum National d'Histoire Naturelle, Paris; type locality, Akaroa, New Zealand).

*Berardius arnouxi* Flower, 1872: 12 (osteology, taxonomy); MacLachlan, Liversidge and Tietz, 1966: 91 (first South African record); Best, 1971: 2 (identification).

### Records and material

The only record of *B. arnouxi* for the SE coast of southern Africa is a 9,3 m male that stranded 3 km westward of the Kromme River Mouth (34° 10′S, 24° 12′E) on 31 December 1962 (MacLachlan *et al.*, 1966) (Fig. 34). The skull, mandibles, two teeth and six colour slides of the carcase are in the collection of the Port Elizabeth Museum (PEM 1496/67).

### Specific status and characters

It is still uncertain whether *B. bairdi* is specifically distinct from *B. arnouxi*, though the two forms differ in size and some morphological features.

*B. bairdi* attains a greater length than *B. arnouxi*. The maximum and modal lengths of 631 male *B. bairdi* were 11,6 m and 10,7 m respectively and those of 293 females were 12,2 m and 10,8 m respectively (Omura *et al.*, 1955). The maximum length recorded for *B. arnouxi* is that of the type specimen, 9,75 m. A specimen 9,3 m in length was physically immature (Flower, 1872) whereas another, 8,8 m in length, was physically mature (Hale, 1962). The lengths of five further specimens of *B. arnouxi* were 9,3 m, 9,15 m, 8,8 m, 8,5 m and 8,5 m (McCann, 1975; MacLachlan *et al.*, 1966).

Several external and skeletal differences between the two species have been proposed by various authors, but many of these have been invalidated as new specimens of *B. arnouxi* have become available. True (1910) suggested that *B. bairdi* had wider flukes, longer flippers and a lower dorsal fin situated more posteriorly than in *B. arnouxi*. In Table 34 the available published measurements of the appendages of *B. arnouxi* are compared with those of a sample of 28 *B. bairdi* from Japanese waters (Omura *et al.*, 1955) and two specimens from St. George Island (True, 1910). These measurements confirm the conclusions reached by MacLachlan *et al.* (1966) that the height and position of the dorsal fin and the width of the flukes are of no value as specific characters. The flippers of *B. arnouxi*, however, appear to be proportionately shorter than those of *B. bairdi*. The length from the tip of the snout to the blowhole is proportionately slightly less in *B. bairdi* than in *B. arnouxi*, possibly reflecting the greater total length of the former species.

Comparison of the cranial and mandibular measurements of eight adult *B. bairdi* and 13 adult *B. arnouxi* (Table 35) provided by McCann (1975) and those of PEM 1496/67 (from Table 32) confirms True's opinion that there are no significant differences in dimensions between the two species, with the exception of the greater cranial and mandibular lengths of *B. bairdi*.

Two cranial features noted by True (1910) appear to differ consistently between the two species. In dorsal view the lateral margins of the nasal bones on the vertex of the skull in *B. bairdi* (five specimens) are sub-parallel or expanded slightly posteriorly (True, 1910; McCann, 1975) whereas the anterior part of these bones is considerably expanded laterally in *B. arnouxi* (seven specimens) (True, 1910; Hale, 1962; McLachlan *et al.*, 1966; Moore, 1968; McCann, 1975).

In ventral view of the skull, the posterior margin of the vomer is deeply notched in *B. bairdi* (five specimens) (True, 1910; McCann, 1975) and straight or slightly notched in *B. arnouxi* (five specimens) (True, 1910; MacLachlan *et al.*, 1966; McCann, 1975).

True (1910) stated that the tympanic and periotic bones of *B. bairdi* could be distinguished

TABLE 34:

Comparison of selected external measurements of *Berardius arnouxi* and *Berardius bairdi*. Total length is expressed in metres; other measurements are expressed as percentages of total length. Measurement numbers are keyed to Table 2.

| Meas. No. | *B. bairdi* | | | | *B. arnouxi* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Omura *et al.*, 1955 | | | St. George Island True, 1910 | St. George Island True, 1910 | Wellington True, 1910 | Porirua Flower, 1872 | Canterbury Flower, 1872 | Worser's Bay Flower, 1872 | Port Lorne Hale, 1962 | Kromme River Mac-Lachlan *et al*, 1966 | Canterbury McCann 1975 |
| | N | x̄ | Range | | | | | | | | | |
| 1 | 28 | 10,35 | 9,7–11,2 | 12,24 | 7,75 | 8,38 | 8,22 | 9,30 | 8,22 | 8,85 | 9,30 | 8,85 |
| 9 | 27 | 11,0 | 10,0–12,1 | 10,8 | 11,8 | 12,8 | — | — | 13,0 | 11,7 | 12,3 | 12,4 |
| 11 | 28 | 63,3* | 62,9–68,0 | (70,3) | (70,8) | (65,4) | — | — | — | 66,3 | 63,4 | 69,5 |
| 27 | 27 | 12,2 | 10,5–13,4 | 12,4 | 13,4 | 9,4 | 11,1 | 5,2† | — | 8,9 | 7,9 | — |
| 30 | 26 | 2,6 | 1,9– 3,3 | 2,5 | 2,4 | 3,0 | — | — | — | 1,7 | 1,6 | — |
| 32 | 7 | 28,8** | 27,2–31,8 | 25,3 | 24,6 | 19,1 | 25,9 | 21,3 | — | 25,3 | 27,9 | 27,6 |

* Calculated from (Total length – posterior margin of dorsal fin + dorsal fin base).

** Omura *et al.* (1955) measured from tip of one fluke to the notch. Their values have been doubled in this table.

† Points of measurement are not stated.

( ) Total length – length from anterior insertion of dorsal fin to "end of body"?

Table 35:

Comparison of cranial and mandibular measurements of *Berardius arnouxi* and *Berardius bairdi* provided by McCann (1975), and including those of PEM 1496/67. Condylobasal length and mandibular length are expressed in mm. Other measurements are expressed as percentages of CBL or mandibular length respectively. Measurement numbers are keyed to Table 3 or 4.

| Measurement Numbers | *B. arnouxi* | | | *B. bairdi* | | |
|---|---|---|---|---|---|---|
| | x̄ | Range | N | x̄ | Range | N |
| *Cranial Measurements:* | | | | | | |
| 1 | 1 277 | 1 174 – 1 420 | 13 | 1 430 | 1 343 – 1 524 | 8 |
| 2 | 65,4 | 60,7 – 68,1 | 9 | 64,8 | 63,0 – 69,5 | 7 |
| 3 | 77,9 | 73,2 – 81,9 | 8 | 77,4 | 64,4 – 82,3 | 7 |
| 18 | 52,3 | 48,9 – 56,5 | 13 | 49,8 | 47,1 – 52,0 | 6 |
| 19 | 51,1 | 45,6 – 56,3 | 11 | 49,1 | 47,9 – 52,6 | 8 |
| 21 | 15,6 | 13,9 – 17,5 | 12 | 16,5 | 15,4 – 17,4 | 8 |
| 23 | 11,8 | 10,7 – 13,2 | 8 | 12,2 | 11,5 – 12,9 | 8 |
| 24 | 5,6 | 4,4 – 6,8 | 11 | 5,6 | 4,8 – 6,1 | 7 |
| 29 | 16,0 | 14,9 – 16,8 | 8 | 14,0 | 13,1 – 15,1 | 8 |
| 31 | 16,1 | 15,0 – 18,5 | 12 | 16,4 | 15,2 – 17,8 | 8 |
| 33 | 33,2 | 30,6 – 35,3 | 9 | 30,5 | 29,6 – 31,0 | 3 |
| 35 | 12,6 | 10,7 – 14,6 | 12 | 14,2 | 13,6 – 15,1 | 8 |
| 37 | 6,7 | 5,1 – 7,5 | 12 | 7,0 | 6,7 – 7,2 | 8 |
| 39 | 40,9 | 35,5 – 45,2 | 12 | 39,1 | 36,9 – 40,5 | 7 |
| *Mandibular Measurements:* | | | | | | |
| 1 | 1 137 | 1 011 – 1 240 | 10 | 1 298 | 1 190 – 1 360 | 7 |
| 2 | 24,7 | 20,5 – 28,1 | 11 | 22,2 | 21,2 – 22,9 | 4 |
| 3 | 18,3 | 16,7 – 20,2 | 10 | 18,2 | 17,4 – 20,3 | 7 |

from those of *B. arnouxi*. Comparisons of these bones from further specimens by Hale (1962) and Kasuya (1973), however, indicated that they were not specifically different.

The vertebral formulae of three *B. arnouxi* provided by True (1910) are C7 T10 L12 Cd19 = 48; C7 T10 L12 Cd17 (+2) = 46 (+2); C7 T10 L13 Cd17 = 47. The formula of the specimen examined by Hale is C7 T11 L12 Cd19 = 49. The vertebral formula of three *B. bairdi* is C7 T11 L12 Cd16 + = 46 + (True, 1910). McCann (1975) maintained that the number of thoracic vertebrae is characteristic for each species. Hale's (1962) specimen appears to invalidate this statement, as this animal had 11 ribs on one side and 10 ribs on the other side. Further material from both species is required before this point can be settled satisfactorily.

In summary very few features serve to distinguish *B. bairdi* from *B. arnouxi*. The most distinctive of these features is the greater length attained by the former species. The relevance of size differences as important specific characters in cetacean taxonomy has not been clearly established, but the ratio of the greatest lengths attained by the two species of *Berardius* (approximately 1 : 1,25) is similar to that of the western and eastern North Atlantic populations of the bottlenosed dolphin, *Tursiops truncatus*, which reaches lengths of approximately 2,9 m (Mead, 1975) and 3,6 m (Fraser, 1953) respectively. Such size differences may be a reflection of different environmental conditions though there is little direct evidence at present to support this suggestion. The remaining differences between *B. arnouxi* and *B. bairdi* are comparable in number and degree to those demonstrated between northern and southern hemisphere populations of True's beaked whale, *Mesoplodon mirus* (present study). A re-evaluation of the specific status of *B. bairdi* and *B. arnouxi* will require larger samples of skeletal material and, if the opportunity arises, should also include other techniques such as studies of blood proteins. On the evidence presently available there is little to suggest that *B. bairdi* is specifically different from *B. arnouxi*.

## DESCRIPTION

The illustration of *B. arnouxi* (Fig. 11) is based on photographs of a 9,3 m long adult male, PEM 1496/47, supplemented with details of the throat grooves of an old male illustrated by McCann (1975).

The body of *B. arnouxi* is robust, rounded anteriorly and becoming progressively compressed laterally in its posterior third. The melon is bulbous in adults (though probably less bulbous in juveniles, as in those of *B. bairdi*—Omura *et al.*, 1955). The anterior face of the melon is somewhat flattened and slopes steeply down to merge smoothly with the prominent, rounded beak. The protruding tip of the lower jaw bears the larger, anterior pair of teeth, which erupt anterior to the tip of the upper jaw. The line of the gape is slightly sigmoid in lateral view. The flippers are broad, tapering abruptly to a rounded apex. The dorsal fin is roughly triangular and rounded at the tip in PEM 1496/67.

The colour pattern of *B. arnouxi* is not well known. Two New Zealand specimens were described as black with a narrow band of grey on the belly (Flower, 1872; McCann, 1975); one of these was examined a week after stranding and the time elapsed prior to examination is not known for the second animal. McCann (1975) examined an old male, partly decomposed, in which the dorsal surface from the melon to behind the dorsal fin was dirty white in colour. The rest of the body was brownish black.

MacLachlan *et al.* (1966) reported that the colour of PEM 1496/67 was black after it had lain on the beach for one or more days. Colour slides taken during their examination, however, clearly show that the beak was pale grey anterior to the melon. The anterior face of the melon was black but the dorsal and upper lateral surfaces of the melon were distinctly greyish black in colour as far as a few centimetres posterior to the blowhole. The dorsal fin was also greyish black, contrasting with the more intense black colour of the back.

Adult *B. arnouxi*, particularly male specimens, usually have numerous linear, single or paired scars over the dorsal and other surfaces of the body which are thought to be the result of intraspecific aggression and oval scars ventrally and laterally of unknown origin (McCann, 1975).

The skeletal characters of *B. arnouxi* have been described in some detail by Flower (1872), True (1910), Hale (1962), MacLachlan *et al.* (1966) and McCann (1975). Cranial and mandibular measurements of PEM 1496/67 are provided in Tables 31 and 32.

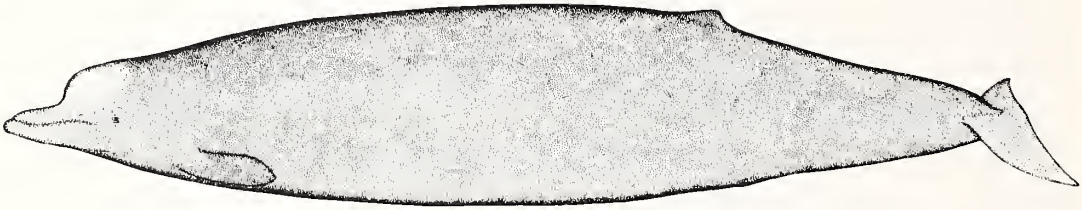


Fig. 11. Adult male *Berardius arnouxi*, 9,30 m in length, from the eastern Cape (PEM 1496/47).

### Biology

*Age determination*: A half section of one of the anterior teeth of PEM 1496/67 shows a similar structure to that of a tooth of *B. bairdi* described by Omura *et al.* (1955). The following growth sequence is suggested. The pulp cavity of the tooth is initially filled with dentine showing some distinct growth layers. Subsequently nodular secondary dentine is laid down in the centre of the pulp cavity and at the base of the tooth to form a sub-spherical mass. The length of the tooth is further extended by the transverse deposition in the basal portion of the tooth of vascularized dentine which is chalky in appearance in reflected light and resembles the dentine described in male *Mesoplodon mirus* teeth. On the outer surface of the tooth cement is deposited which extends basally as the tooth increases in length and eventually covers the base of the tooth in a layer up to 12 mm thick. The cement shows well-defined growth layers. At least 14 layers can be counted in the cement up to the point when the layers begin to form over the base of the tooth and a further 16 layers are visible in the cement forming the base of the tooth, making a total of 30 cement layers in PEM 1496/67.

Recently Kasuya (1977) concluded that the growth layers in the cement are formed annually in *B. bairdi*.

*Growth and development:* No data.

*Reproduction:* There are no data for *B. arnouxi*. For *B. bairdi* Kasuya (1977) calculated a gestation period of 17 months which is the longest period on record for any cetacean species.

*Food and feeding:* Haast (*in* Flower, 1872) recorded about "half a bushel" of cephalopod beaks in the stomach of a specimen of *B. arnouxi* stranded in New Zealand. Nishiwaki and Oguro (1971) examined 383 stomachs of *B. bairdi* containing food. Of these, 40,7 per cent contained deep-sea fish, 28,9 per cent contained squid and 23 per cent contained other fishes such as mackerel, sardine, flat fish, pollack and saury. The contents of the remainder of the stomachs were not identified.

### Distribution and migration

*B. arnouxi* has a circumpolar distribution in the Southern Ocean. Thirty strandings have been recorded in New Zealand waters (McCann, 1975) and there are single records for South Australia, South Africa, Argentina, South Shetland Islands, Falkland Islands and the Antarctic Peninsula (Brownell, 1974). The Argentinian and South African records are the most northerly ones (latitude 34° S), the majority of records (89 per cent) being south of latitude 40° S.

The occurrence of strandings is markedly seasonal. Ten dated records from New Zealand were for the months of December (2), January (5), February (2) and March (1) (McCann, 1975; Gaskin, 1968a). The South African and Australian records (Hale, 1962) were both for December. The most southerly record, from the Antarctic Peninsula, was of a whale trapped in a pool surrounded by ice formed in April. The Argentinian record was for the month of May. Wilson (1907) recorded a group of six to eight bottlenosed whales at McMurdo Sound in February 1902. Though he identified them as a species of *Hyperoodon*, the outline sketch he made more closely resembles *B. arnouxi* than *H. planifrons* in both the shape of the melon and its junction with the dorsal surface of the upper jaw. Although these strandings do not clearly indicate migratory behaviour they do suggest that *B. arnouxi* moves onshore during the summer months. In the North Pacific Ocean *B. bairdi* moves onshore and northwards past the Japanese coast in a similar season, between mid-May and the end of September (Nishiwaki and Oguro, 1971).

## Genus *HYPEROODON* Lacépède, 1804

*Hist. Nat. Cetaces, pp. xliv, 319; type species, Hyperoodon butskopf* Lacepede by monotypy.

These animals are medium sized whales up to 9 m in length. Adult males develop a bulbous melon that may overhang the distinct beak.

Two cranial features distinguishing this genus from other recent ziphiid genera.

When the skull is upright with the long axis of the rostrum horizontal the dorsal apices of the maxillary prominences are well above the mesethmoid bone.

The greatest length of the largest maxillary foramen is greater than the least distance between the pair of premaxillary foramina in that individual.

The seven cervical vertebrae are fused into a single mass, unlike the condition in other ziphiids (Fraser, 1945). Some specimens of this genus exhibit a greater reduction in the number of thoracic vertebrae and ribs (eight) than is shown by any other mammalian genus (Fraser, 1945).

Two species are recognized. *H. ampullatus* (Forster, 1770) is restricted to the colder waters of the North Atlantic Ocean. *H. planifrons* Flower, 1882 inhabits the Southern Ocean and waters adjacent to it.

## ***Hyperoodon planifrons*** Flower, 1882
### Southern Bottlenosed Whale

*Hyperoodon planifrons* Flower, 1882: 392 (holotype, skull, BM 1814a-82.3.24.1; type locality, Lewis Island, Dampier Archipelago, Western Australia; Tietz, 1966: 101 (first South African record); Best, 1971: 2 (identification).

### RECORDS AND MATERIAL

Three specimens of *H. planifrons* are known from South African waters; details of these are provided in Table 36. SAM 37146 will be described in more detail by Best *et al.* (in prep). Part of the postcranial skeleton of PEM 1503/22 (vertebrae anterior to L2, ribs, scapulae, hyoids) collected subsequent to Tietz' (1966) report were also available for the present study.

TABLE 36:

Records and material of *Hyperoodon planifrons* on the SE coast of southern Africa.

| Catalogue Number | Sex | Total length (mm) | CBL (mm) | Date | Locality | Comments |
|---|---|---|---|---|---|---|
| PEM 1503/22 | ♂ | 6 360 | 1 210 | 18.01.64 | Humewood, Port Elizabeth | Skull, mandibles, tooth and partial skeleton in PEM (Tietz, 1966). |
| SAM 37146 | ♂ | 6 425 | — | 19.01.75 | 33° 35′S, 28° 04′E | Harpooned at sea. Whole skeleton in SAM. |
| PEM 1520/30 | ♂ | 2 910 | —* | 07.11.76 | Blythesdale Beach, Natal | Stranded alive, Cast in prep. for Natal Museum. Nearly complete skeleton in PEM. |

* Head frozen for dissection overseas at the time of writing.

Sightings of single or small groups of large beaked whales were made frequently on the whale marking cruises held in the summer months. The specific identity of most of these could not be established, but several records have been attributed to *Hyperoodon* on the basis of overall size, a whitish grey body colour, a relatively high and broad triangular dorsal fin and a projecting bulbous melon often visible when an animal jumped clear of the water. Localities and dates of 22 such sightings are provided in Table 37, and mapped in Fig. 31.

TABLE 37:

Sight records of ziphiids, tentatively assigned to *Hyperoodon planifrons*, on the SE coast of southern Africa. Data taken from Gambell *et al*, (1975); IOS (1973, 1975).

| Date | Number | Co-ordinates |
|---|---|---|
| 14.02.73 | 4 | 35° 15'S, 25° 42'E |
| 15.02.73 | 3 | 34° 55'S, 26° 45'E |
| 21.02.73 | 5 | 35° 00'S, 26° 17'E |
| 24.12.73 | 3 | 37° 45'S, 32° 54'E |
| 02.02.74 | 6 | 32° 16'S, 32° 54'E |
| 03.02.74 | 4 | 32° 06'S, 32° 19'E |
| 03.02.74 | 4 | 31° 54'S, 32° 11'E |
| 19.01.75 | 3 | 33° 14'S, 28° 53'E |
| 20.01.75 | 4 | 34° 31'S, 26° 32'E |
| 22.01.75 | 5–6 | 35° 38'S, 22° 53'E |
| 22.01.75 | 10 | 36° 25'S, 22° 44'E |
| 23.01.75 | 4–5 | 37° 10'S, 22° 50'E |
| 23.01.75 | 7; 6 | 37° 15'S, 23° 00'E |
| 25.01.75 | 3–4 | 36° 15'S, 23° 08'E |
| 25.01.75 | 3 | 36° 06'S, 23° 25'E |
| 25.01.75 | 3 | 36° 10'S, 23° 30'E |
| 26.01.75 | 2 | 35° 54'S, 25° 07'E |
| 26.01.75 | 5 | 35° 14'S, 25° 25'E |
| 26.01.75 | 3 | 35° 03'S, 25° 28'E |
| 27.01.75 | 3 | 35° 10'S, 25° 10'E |
| 27.01.75 | 5 | 35° 05'S, 25° 15'E |
| 28.01.75 | 3 | 34° 30'S, 26° 47'E |

## SPECIFIC STATUS AND CHARACTERS

In his description of the type of *H. planifrons*, Flower (1882) described two cranial features which continue to distinguish *H. ampullatus* from all material of *H. planifrons* examined to date (Hale, 1931; Fraser, 1945; Tietz, 1966; Gianuco and Castello, 1976).

In *H. planifrons* the maxillary prominences or crests are comparatively low, originating on the rostrum about one-third of its length from the base and, in profile, slope gradually to a summit above the antorbital notch before descending gradually as far as the posterior of the maxillary plate. In *H. ampullatus* the summits of the maxillary crests are higher than the vertex of the skull in all but the most juvenile animals.

The premaxillary crests on the vertex overhang the superior nares in *H. planifrons* so that the nares are almost obscured in dorsal view of the skull. In *H. ampullatus* the profile of the premaxillary crests is approximately vertical.

*H. ampullatus* appears to attain a greater length than *H. planifrons*. The modes in length of mature male and female *H. ampullatus* were 8,2 m and 7,3 m respectively (Benjaminsen, 1972). Males and females seldom exceed 9,8 m and 8,5 m in length respectively. Only five of the 16 records of *H. planifrons* for which lengths are available (Gianuco and Castello, 1976; present study) exceed 7 m in length and the greatest length recorded is 7,5 m. The sex is recorded for only one of these five animals, a female 7,45 m in length. The lengths of four known males are 6,36 m, 6,43 m, 6,54 m and 6,93 m.

### DESCRIPTION

The 2,91 m long juvenile male PEM 1520/30, stranded in Natal, is illustrated in Fig. 12. This specimen appears to be the first juvenile of this species to be examined and has been illustrated here to facilitate comparisons with older animals showing the bulbous melon typical of *H. planifrons*.

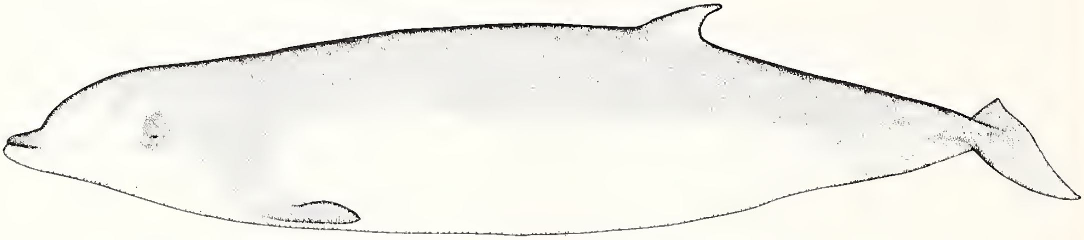


Fig. 12. Juvenile male *Hyperoodon planifrons*, 2,91 m in length, from Natal (PEM 1520/30).

The body of *H. planifrons* is robust, slightly compressed laterally, particularly in the posterior third of the body. The beak is short, rounded and stout. The tip of the lower jaw scarcely protrudes beyond that of the upper jaw (Table 38, meas. no. 16). The line of the gape is horizontal anteriorly, curving upwards slightly at midlength and becoming horizontal again posteriorly. The upward curvature of the gape is least pronounced in the juvenile male and most pronounced in the 6,43 m animal SAM 37146. The margins of the tongue of the juvenile male are fimbriated, especially on the lateral edges.

In profile the dorsal surface of the upper jaw rises posteriorly to the apex of the melon. This apex is characteristically well defined. In the juvenile male, PEM 1520/30, the melon is well-formed, distinct and tapers anteriorly in lateral and dorsal views. In profile the anterior margin of the melon initially slopes posteriorly from the apex at an angle of about 60° to the long axis of the body. With increasing age the melon becomes bulbous and in PEM 1503/22 and SAM 37146 the anterior face of the melon is flattened and rises almost vertically from the upper jaw.

The blowhole is transverse and curved slightly forwards on each side in the juvenile PEM 1520/30 and in SAM 37146.

The throat grooves in all three southern African specimens diverge posteriorly each groove being straight anteriorly but curving laterally in the posterior quarter of its length.

The flippers of PEM 1520/30 are slightly convex along their ventral margin and more convex along the dorsal margin. The mesial surface of the flipper fits into a well defined depression in the body wall. The depression is deepest close to the axilla and becomes progressively shallower ventrally and distally.

The dorsal fin of PEM 1520/30 is convex anteriorly in profile, deeply concave posteriorly and has a rounded tip. The fin of SAM 37146 is tall and slightly falcate.

External measurements of the three South African specimens are given in Table 38.

Few descriptions exist of the colour pattern of *H. planifrons*. L. H. Matthews (*in* Fraser, 1945) described the colour of a 4,63 m long animal as black shading to grey ventrally. Fraser (1945) noted that the mouth and throat of a second animal were paler than the surrounding skin and that the skin was streaked with longitudinal scars. The 6,9 m long male described by Hale (1931) was bluish black above and creamy or grey on the belly.

Tietz (1966) stated that the specimen stranded at Humewood (PEM 1503/22) was cloud

TABLE 38:

External measurements to the nearest 5 mm (except numbers 16, 18 and 23) of three male *Hyperoodon planifrons* from southern Africa. Measurement numbers are keyed to Table 2.

| Measurement Number | PEM 1503/22* | SAM 37146 | PEM 1520/30 |
|---|---|---|---|
| 1 | 6 360 | 6 425 | 2 910 |
| 2 | 790 | 800 | 430 |
| 3 | 215 | 250 | 95 |
| 4 | 510 | 460 | 260 |
| 5 | — | 950 | — |
| 6 | — | 175 | — |
| 7 | 405 | 450 | 190 |
| 8 | — | 650 | (R)270, (L)230 |
| 9 | 740 | 750 | 410 |
| 10 | 1 470 | 1 410 | 710 |
| 11 | 4 100 | 3 930 | 1 820 |
| 12 | — | 4 410 | 2 020 |
| 13 | — | 2 940 | 1 450 |
| 14 | — | 4 170 | 1 780 |
| 15 | — | 4 560 | 2 030 |
| 16 | — | 17,5 | 12 |
| 17 | 695 | 770 | 390 |
| 18a | — | 130 | 26 |
| b | — | 80 | 22 |
| c | — | 80 | 20 |
| 19a | 255** | 410 | 250 |
| b | — | 415 | 250 |
| 20 | — | (3 720) | 1 320 |
| 21 | — | — | 1 420 |
| 22 | — | 2 620 | 1 060 |
| 23 | — | 45 | 27 |
| 24a | — | 30 | 35 |
| b | — | 40 | 35 |
| 25a | 230 | 30 | 170 |
| b | 150 | 25 | 80 |
| c | — | — | — |
| 26 | 180 | 180 | 85 |
| 27 | 685 | 660 | 290 |
| 28 | — | 520 | 175 |
| 29 | 230 | 200 | 80 |
| 30 | 290 | 370 | 130 |
| 31 | 420 | 520 | 210 |
| 32 | 1 640 | 1 700 | 620 |
| 33 | — | 560 | 205 |

* From notes in PEM files and Tietz (1966)
** Side not recorded
( ) denotes approximate measurement.

grey in colour but paler along the flanks and underside of the belly. The photographs of SAM 37146 were unfortunately taken in poor lighting conditions. However, this animal appears to be entirely brownish grey with pale grey or cream outlines to the genital, anal and mammary slits. A few longitudinal and oval scars are apparent on the flanks.

The juvenile male stranded alive and was frozen shortly after death. The author took photographs of this whale while it was thawing on an overcast day and post-mortem changes are considered to be minimal. Most areas that had been white in life were pinkish or purplish owing to extravasation of blood into the skin during storage and thawing.

Posterior to the blowhole the entire dorsum of this animal is a dark bluish black, becoming dark grey laterally prior to merging smoothly into the white colour of the ventral surface. Posterior to the eye the dark bluish black of the dorsum extends ventrally in a broad band towards the anterior insertion of the flipper, becoming greyish black as it does so. A dark band of bluish black also extends ventrally from the blowhole to join with an intensely black patch surrounding the eye. Anterior to the blowhole dark grey pigment is present in the midline as far as the apex of the melon, in an antero-lateral streak over the upper half of the melon and anterior to the eye. Much of the upper jaw and the dorsal margin of the lower jaw tip are intensely black, contrasting with the white colour of the rest of the face, lower jaw and throat. The flippers are black externally and white internally. The posterior margin and the anterior third of the dorsal fin are dark grey-black and enclose a whitish fin blaze. In the posterior half of the caudal peduncle the dark grey of the dorsal margin extends to mid-depth of the peduncle. Ventrally in this region the skin is pigmented with fine flecks and streaks of dark and pale grey. The dorsal surface of the flukes is black. On the ventral surface the margins of the flukes are bluish-black. In the middle third of the trailing edge of the flukes this dark margin is broadened anteriorly as far as the junction of the caudal peduncle and the fluke surface and from its anterior margin numerous fine grey streaks radiate across the whitish ground colour of the ventral surface as far as the leading edge of the flukes.

The skull of PEM 1503/22 has been described and illustrated by Tietz (1966) and cranial and mandibular measurements of this specimen were supplied by this writer to Moore (1972). The head of the juvenile male PEM 1520/30 is at present deep frozen pending dissection of the air sac and sinus systems. Cranial details of specimens from elsewhere are given by Fraser (1945) and Hale (1931).

The formula of the available vertebrae of PEM 1503/22 is C7 T8 L2+. None of the vertebral epiphyses posterior to the sixth cervical vertebra is fused to its centrum. All seven cervical vertebrae are characteristically fused so that the centra of C1–C6 are indistinguishable from each other. The ventral halves of the neural arches of the sixth and seventh cervical vertebrae are free but are fused with the rest of the cervical vertebrae dorsally. The sixth cervical vertebra has a strong inferior lateral process projecting anteriorly. In this respect and in overall appearance this specimen resembles very closely the specimen illustrated by Fraser (1945).

PEM 1503/22 has eight pairs of ribs of which the anterior six are bicipital. The last cervical and first five thoracic vertebrae bear facets on the posterior edge of their centra for the capitulum of each of these six ribs. The tubercula of the bicipital ribs articulate with the upper transverse processes (of Flower, 1885b) of the first six thoracic vertebrae. The sixth thoracic vertebra has a vestige of an inferior transverse process. The seventh thoracic vertebra has both superior and inferior transverse processes which are joined distally. Only the inferior transverse process is present on the eighth thoracic vertebra. Metapophyses are apparent on the seventh and well developed on the eighth thoracic vertebrae respectively.

The vertebral formula of the juvenile PEM 1520/30 is C7 T10 L12 Cd7+ = 32+. Most of the caudal vertebrae were lost in storage prior to preparation. The first five cervical vertebrae are fused together. The presence of ten pairs of ribs in this specimen is interesting and appears to be the first record for the genus of more than nine pairs of ribs. The vertebral formulae of six specimens of *H. planifrons* provided by Fraser (1945), Hale (1931) and Gianuco and Castello (1976) all have eight or nine thoracic vertebrae:

C7 T9 L10 Cd20 = 46; C7 T8 L12 Cd17 = 44;
C7 T8 L12 Cd17 (+1) = 44(+1); C7 T8 L12 Cd19 = 46;
C7 T9 L10 Cd20 = 46; C7 T8 L11 Cd17 (+2?) = 43 (+2?).

In PEM 1520/30 the anterior seven pairs of ribs are bicipital. The tubercle of the seventh rib articulates with the superior transverse process. On the eighth thoracic vertebra, however, there is an abrupt replacement of the superior transverse process by an inferior transverse process. The transitional form seen in PEM 1503/22 is not present in this juvenile.

## BIOLOGY

*Age determination:* The external appearance of the single tooth collected from PEM 1503/22 has been described and illustrated by Tietz (1966). In a ground longitudinal section, 0,2–0,3 mm thick, eight layers are visible in the postnatal dentine. Each layer consists of an opaque zone which is deposited first and is followed by a thinner translucent zone. The eighth layer contains a complete opaque zone and part of a translucent zone suggesting that this layer is near completion.

The prenatal dentine of this tooth forms a cone 15 mm in length and 9 mm in diameter at its base. The sides of the cone are slightly convex, tapering to an acute apex. The first three postnatal layers contribute 75 per cent of the length of the tooth and each succeeding layer adds a progressively smaller increment to the tooth length.

The teeth of the juvenile male PEM 1520/30 have not been extracted from the mandibles as the head has been preserved intact. However, some features of their structure are visible in a radiograph used to confirm the identity of this specimen. In lateral view each tooth appears as a hollow, evenly-tapered cone 20 mm in length and 11,5 mm in diameter at the base. The total thickness of the tooth near the apex of the pulp cavity is approximately 1 mm.

*Growth and development:* The umbilicus of the 2,91 m juvenile appeared to be completely healed. However, on the right side of the body were visible at least 6 narrow, vertical, dark streaks which are thought to be the remnants of the birth creases seen in other neonatal cetaceans. These creases may persist visibly for at least one month after birth in *Tursiops aduncus* (Ross, pers. obs.). On this evidence it is suggested that PEM 1520/30 was not more than a few weeks old. The length of this animal is comparable with length at birth of *H. ampullatus* which is approximately 3 m (Benjaminsen, 1972).

The total mass of PEM 1520/30 was 228 kg. The blubber weight posterior to the head was 14,1 per cent of body mass and the epiaxial and hypoaxial fillets constituted 46,2 per cent of body mass.

*Reproduction:* There appears to be no published information on reproduction in *H. planifrons*.

The testes of PEM 1520/30 measured 41 × 14 mm and 40 × 15 mm and weighed 3,7 g and 3,2 g respectively. Histological sections through the centre of the testis showed abundant interstitial tissue and narrow tubules with a reduced lumen or no lumen. The mean tubule diameter at the centre and periphery of the testis at midlength was 35 $\mu$.

The length at sexual maturity is not known. Benjaminsen (1972) concluded that sexual maturity in *H. ampullatus* is attained when 9–11 dentine layers have been deposited. If *H. planifrons* is similar to *H. ampullatus* in this respect, PEM 1503/22 (6,36 m in length, 7+ dentine layers) was probably sexually immature.

The recently born juvenile PEM 1520/30 provides the only definite information on the period of calving. This animal stranded on 7 November and was probably born in late September or October, suggesting a calving season in the months of spring or early summer. On 20 January 1975 the author observed two adult beaked whales, assigned to *Hyperoodon*, each accompanied by a calf (Table 37) estimated to be less than half the length of the adults or about 3,0–3,5 m in length. The lengths of these calves indicate that they had been born recently and lend support to the suggestion of a spring or summer calving period. The calving period in *H. ampullatus* is also in spring, reaching its peak in April (Benjaminsen, 1972).

*Food and feeding:* The stomach of PEM 1520/30 was empty. The stomach contents of SAM 37146 have not yet been examined in detail, though four cephalopod beaks were recovered from the intestine.

Hale (1931) recorded a large number of cephalopod beaks in the stomach of the South Australian specimen. A few crystalline eye lenses of cephalopods were also found in the stomach of a specimen examined at South Georgia (Fraser, 1945).

### DISTRIBUTION AND MIGRATION

The distribution of *H. planifrons* south of latitude 35° S has been mapped by Brownell (1974) and details of localities of specimens and sightings attributed to this species have been tabled by Gianuco and Castello (1976). *H. planifrons* has a circumpolar distribution in the Southern Ocean. Nine of the 25 known specimens (Brownell, 1974; Gianuco and Castello, 1976; present study) were collected south of the Antarctic Convergence. The southernmost records are from the South Shetland Islands, close to the Antarctic Peninsula. Six specimens were collected between 45° S and the Antarctic Convergence and eight were collected between 30° S and 45° S. Only two of these 25 specimens have been recorded north of 30° S: the type specimen, collected in the Dampier Archipelago, north western Australia (20° S) and the juvenile animal stranded in Natal (29° S) (present study). These records suggest that *H. planifrons* rarely occurs to the north of latitude 30° S.

Sight records attributed to *Hyperoodon* in southern African waters have been made only south of 30° S (Fig. 34). *Hyperoodon* was the predominant ziphiid sighted between 35° S and 40° S (Gambell *et al.*, 1975; IOS, 1975).

*H. planifrons* appears to occur seasonally in southern African waters. The three specimens are recorded for the summer months of November (1) and January (2). Large beaked whales of which several could be attributed to *H. planifrons* were a consistent feature on all whale-marking cruises made in the summer months but were entirely absent on the 1969 cruise made in August (IOS, 1969). Pilots of the spotter planes operating for Union Whaling Co., Durban confirmed that bottlenosed whales were common early in the season (March, April) but disappeared during the winter months (Mr R. Matthews, *in litt.*).

There are insufficient records from elsewhere to determine whether this species undertakes an annual migration. Ten of the 13 specimens for which the month of occurrence is known are recorded from November to February. The remaining records are for April (latitude 45° S) and August (41° S, 52° S). These records are from between the Antarctic Convergence and Sub-tropical Convergence. The five dated records south of the Antarctic Convergence are for the months of November to January but their apparent seasonality may reflect only the inaccessibility of this region at other times of the year.

## Family PHYSETERIDAE
### Sperm Whales

These are small to large sized whales (2,7 – 18m in length for adults) in which the narrow mouth is situated on the ventral surface of the head. The mandibular symphysis is narrow. Functional teeth are present in the lower jaw set in a long dental groove and in separate alveoli. Rudimentary maxillary teeth may be present. Two or more short throat grooves may be present between the posterior ends of the gape. The blowhole is placed to the left of the midline.

The head bears a large bulbous spermaceti organ which increases in proportion to body size, as body length increases through the family. The maxillary bones and dorsal surface of the skull are cupped to support the spermaceti organ.

The degree of asymmetry and modification of the normal mammalian skull pattern reaches the extreme in this family. The pterygoid bones are thick and meet in the midline. The lacrimal bones are distinct and large. Most or all of the cervical vertebrae are fused (the atlas is free in *Physeter*).

Two recent genera are recognized: the sperm whale *Physeter*, containing the single species, *P. macrocephalus*, which falls outside the scope of this report and the pygmy and dwarf sperm whales, *Kogia* species.

### Genus *KOGIA* Gray, 1846

*Zoology of the voyage of H.M.S. Erebus and Terror*, 1 (Mammalia): 22; type species *Kogia breviceps* (Blainville, 1838) by monotypy.

These are small whales, in length attaining 2,7 to 3,5m. The mouth is short, narrow and ventrally placed. The spermaceti organ is bulbous and variable in shape with age. The blowhole is crescentic, with its convexity facing antero-laterally to the left. The dorsal fin is falcate, set at approximately mid-length; its shape differs specifically. The rostrum of the skull is extremely short and broad. The cervical vertebrae are fused. The scapula is virtually flat, not convex on its outer surface. The teeth are slender, curved and sharply pointed.

Two species are currently recognized: the pygmy sperm *K. breviceps* and the dwarf sperm whale *K. simus* (Handley, 1966). Both species are recorded from southern Africa. The records and the associated biological data for all southern African specimens up to the end of 1975 have been drawn together by Ross (1979). Much of the present report on *Kogia* has been summarized from that paper, together with data on a further eight *Kogia* examined since 1975.

### ***Kogia breviceps*** (Blainville, 1838)
### Pygmy Sperm Whale

*Physeter breviceps* Blainville, 1838: 337 (holotype, skull, Museum National d'Histoire Naturelle, Paris no. 1927:3; type locality, Cape of Good Hope).

*Kogia breviceps* Gray, 1846: 22; Sclater, 1901: 190 (further records); FitzSimons, 1920: 216; Roberts, 1951: 222; Ellerman, Morrison-Scott and Hayman, 1953: 327; Barnard, 1954: 16; Best, 1971: 3 (identification); Ross, 1979: 259 (new records).

RECORDS AND MATERIAL

Prior to 1976, 41 strandings of *K. breviceps* representing 48 animals had been recorded on the southern African coast; 31 of these whales were recorded on the SE coast (Ross, 1979). Details of two subsequent strandings in this region are given in Table 39.

SPECIFIC STATUS AND CHARACTERS

Seven species of *Kogia* have been described since Blainville (1838) described the holotype of *K. breviceps* from a skull collected at the Cape of Good Hope, but for many years workers have accepted that there was a single, variable species. Handley (1966), however, established that there are two well defined species. Comparison of the southern African material of *K. breviceps* and *K. simus* confirmed Handley's conclusions in all but two of his distinguishing features (Ross, 1979; present material). These features are presented for both species in tabular form to facilitate comparisons, using measurements pertaining to all southern African material (Table 42). Handley (1966) considered that the foramen magnum was closer to mid-height of the skull in *K. breviceps* than in *K. simus* and that the dorsal fin was set more posteriorly in *K. breviceps* than in *K. simus*. Measurements of the southern African material, however, indicate that, though there are trends towards such differences, there is a great deal of overlap between the two species in these two characters which thus have little diagnostic value.

The rectangular shape of the snout in lateral view of adult *K. breviceps* is characteristic (Fig. 13). The snout changes in shape with age, and in animals less than 2,3 m in length the shape of the snout is very similar in both *Kogia* species. However, the two species may be distinguished at all ages, including the late foetal stage, by the position of the blowhole which is

Table 39:

Records of three *Kogia breviceps* and five *Kogia simus* from the SE coast of southern Africa.

| Catalogue Number | Sex | Total Length (mm) | CBL (mm) | Date | Locality | Comments |
|---|---|---|---|---|---|---|
| *K. breviceps* | | | | | | |
| PEM 1520/13 | ♀ | 2660 | 392 | 21.08.76 | Wilderness | Pregnant, lactating, 310 mm foetus. Stranded with PEM 1520/14. |
| PEM 1520/14 | ♀ | 2040 | 275 | 21.08.76 | Wilderness | Stranded with PEM 1520/13. |
| PEM 1520/22 | ♀ | 3040 | 417 | 03.10.76 | Cape St. Francis | Stranded alive. |
| *K. simus* | | | | | | |
| ELM 935 | ♀ | 2500 | 284 | 21.12.76 | Orient Beach, East London | Stranded alive. Foetus 960 mm in length. |
| PEM 1520/66 | ♀ | 2200 | (207) | 30.07.77 | near Port Alfred | Stranded with PEM 1520/67, lactating. |
| PEM 1520/67 | ♀ | 1470 | 282 | 30.07.77 | near Port Alfred | Stranded with PEM 1520/66. |
| PEM 1520/72 | ♀ | 2160 | 291 | 05.09.77 | near Kabeljous River Mouth | Decomposing when found. |
| PEM 1520/89 | ♂ | 1710 | — | 22.11.77 | Maitland River Mouth | Stranded alive. |

( ) denotes approximate measurement.

more than 10 per cent of body length from the snout in *K. breviceps* (10,4–12,8 per cent; $\bar{x}$ 11,5; N = 13) and generally less than 10 per cent of body length in *K. simus* (7,2–10,1 per cent; $\bar{x}$ 8,5; N = 22) (Ross, 1979; present study).

## Description

An adult female PEM 1520/13, 3,04 m in length, is illustrated in Fig. 13.

The body of *K. breviceps* is robust, reaching its greatest girth at about mid-length. It is compressed laterally, particularly posterior to the dorsal fin, where the caudal peduncle is deep and strongly compressed laterally.

In young animals the snout is well-formed, pointed and the dorsal surface is inclined antero-ventrally. With age the snout becomes blunter and more rectangular in profile.

The flippers are moderate in size, convex on upper and lower margins and taper evenly to a rounded apex. The dorsal fin is small, low, falcate and placed at about mid-length of the body. The flukes are broad and tapered laterally.

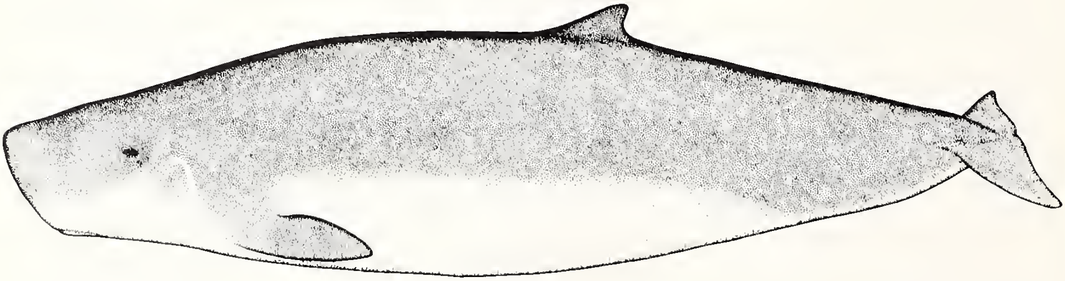


Fig. 13. Adult female *Kogia breviceps*, 3,04 m in length, from the eastern Cape (PEM 1520/13).

External measurements for three *K. breviceps* from the SE coast are provided in Table 40.

The colour pattern of *K. breviceps* has been described by Boschma (1951) and Hale (1963). Although the dorsal colour of PEM 1520/13 (Fig. 13) appears to have darkened to a

TABLE 40:

External measurements in mm of three *Kogia breviceps* and five postnatal and one foetal *Kogia simus* from the SE coast of southern Africa. Measurement numbers are keyed to Table 2.

| Meas. No. | *K. breviceps* | | | *K. simus* | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | PEM 1520/14 | PEM 1520/13 | PEM 1520/22 | ELM 935 (foetus) | PEM 1520/67 | PEM 1520/89 | PEM 1520/72 | PEM 1520/66 | ELM 935 |
| 1 | 2 040 | 2 660 | 3 040 | 960 | 1 470 | 1 710 | 2 160 | 2 200 | 2 500 |
| 2 | 270 | 330 | 400 | 110 | 150 | 210 | 200 | 230 | 250 |
| 4 | 200 | 255 | 240 | 50 | 70 | 95 | 60 | 90 | 100 |
| 5 | 350 | 430 | 500 | 150 | 200 | 260 | — | 305 | 310 |
| 6 | 80 | 95 | 110 | 40 | 50 | 50 | — | 65 | 60 |
| 7 | 185 | 235 | 240 | 90 | 130 | 150 | 170 | 160 | 190 |
| 8(L) | 245 | 320 | 360 | 110 | 160 | 180 | 200 | — | 190 |
| (R) | 285 | 370 | 400 | 140 | — | — | — | 240 | 250 |
| 9 | 220 | 280 | 360 | 75 | 130 | 160 | 155 | 185 | 180 |
| 10 | 440 | 590 | 600 | 210 | 280 | 360 | 370 | 390 | (490) |
| 11 | 1 035 | — | 1 500 | 510 | 700 | 750 | 960 | 1 020 | — |
| 12 | 1 255 | 1 590 | 1 860 | 630 | 915 | 1 020 | 1 260 | 1 295 | — |
| 13 | 810 | 1 355 | — | 390 | — | 650 | — | — | — |
| 14 | 1 340 | 1 860 | 2 090 | 450 | 1 060 | 760 | — | 1 550 | (1 600) |
| 15 | 1 360 | 1 880 | 2 200 | 640 | — | 1 170 | — | — | — |
| 16* | — | — | — | — | — | 90 | 40 | 50 | — |
| 17 | — | — | — | — | — | 110 | — | — | — |
| 18a | — | — | — | — | — | — | — | — | 60 |
| b | — | — | — | — | — | — | — | — | 40 |
| c | — | — | — | — | — | — | — | — | 30 |
| 19a** | — | — | — | — | — | 35 | — | — | — |
| b | — | — | — | — | — | 25 | — | — | — |
| 20 | 870 | 1 100 | 1 680 | 560 | 920 | 1 120 | — | 1 240 | — |
| 21 | 970 | 1 300 | 1 760 | 560 | — | 1 160 | — | — | 1 600 |
| 22 | 630 | 800 | 1 130 | 350 | 680 | 780 | — | 840 | 1 050 |
| 23 | 22 | 40 | 40 | — | 20 | 20 | — | — | 20 |
| 24a | 18 | 24 | 40 | — | — | 0 | — | 35 | — |
| b | 20 | 25 | 50 | — | — | 0 | — | 45 | — |
| 25a | — | — | — | — | — | 110 | — | — | — |
| b | — | — | — | — | — | 60 | — | — | — |
| e | 115 | 180 | 150 | — | 85 | — | — | 145 | 200 |
| 26 | 60 | 85 | 80 | — | 35 | 40 | — | 45 | — |
| 27 | 280 | 385 | 510 | 185 | 220 | 300 | 280 | 320 | 400 |
| 28 | 200 | 265 | 380 | 135 | 150 | 225 | 180 | 230 | 300 |
| 29 | 112 | 135 | 190 | 65 | 90 | 105 | 100 | 120 | 140 |
| 30 | 100 | 100 | 160 | 60 | 105 | 130 | 160 | 180 | 150 |
| 31 | 280 | 250 | 380 | 130 | 215 | 250 | 330 | 310 | 300 |
| 32 | 560 | 720 | 780 | 230 | 375 | 480 | 500 | 510 | 630 |
| 33 | — | — | 260 | 90 | 135 | 260 | 150 | 180 | 210 |
| 34 | 35 | 45 | 55 | 20 | 30 | 35 | 25 | 35 | 30 |

* 16 represents the distance from the apex of the snout to the apex of the upper jaw parallel to the long axis of the body in *Kogia*.

** 19a and b represent maximum and minimum lengths in *Kogia*.

( ) denotes approximate measurement.

dark greyish black, the features of the colour pattern are the same as those described by these authors. The whitish colour of the ventral surface continues onto the ventral surface of the flippers except along their distal margins where they become dark greyish black and onto the ventral surface of the flukes which are dark grey along their anterior and posterior margins. The white bracket-shaped mark ending at the external auditory meatus behind the eye has been described by Hubbs (1951) and several subsequent authors. It was present in all 15 southern African *Kogia* of both species which were fresh enough to show details of colour pattern and it appears to be characteristic of the genus although it was absent in Boschma's (1951) illustration.

The skull of *K. breviceps* is more elongated than that of *K. simus*. Measurements of 25 southern African specimens of all ages (Ross, 1979; present study, Table 41) show that the average length of the rostrum of *K. breviceps* is slightly greater ($\bar{x}$ = 43,8 per cent CBL, limits 36,4–50,5 per cent CBL) than its breadth ($\bar{x}$ = 41,2 per cent CBL, limits 35,2–45,9 per cent CBL). In juvenile specimens in which the rostrum has not attained adult proportions the rostrum is slightly less in length than breadth.

The dorsal cranial fossae of *K. breviceps* are elongated antero-posteriorly and the posterior wall of each fossa slopes gradually from the dorsal rim of the skull. The sagittal septum near the vertex is broad with poorly defined dorso-lateral margins. The lateral walls of the septum slope gradually into the cranial fossa on each side.

TABLE 41:

Cranial and mandibular measurements in mm of three *Kogia breviceps* and four *Kogia simus* from the SE coast of southern Africa. Measurement numbers are keyed to Table 5.

| Measurement Numbers | *K. breviceps* | | | K. simus | | | |
|---|---|---|---|---|---|---|---|
| | PEM 1520/13 | PEM 1520/14 | PEM 1520/22 | PEM 1520/66 | PEM 1520/67 | PEM 1520/72 | ELM 935 |
| 1 | 392 | 275 | 417 | 284 | (207) | 282 | 291 |
| 2 | 170 | 107 | 192 | 107 | (67) | 105 | 107 |
| 3 | 162 | 124 | 187 | 129 | 91 | 127 | 121 |
| 4 | 112 | 97 | 121 | 91 | 60 | 91 | 92 |
| 5 | 339 | 242 | 375 | 243 | 178 | 232 | 245 |
| 6 | (350) | 252 | 378 | 253 | 190 | 237 | 254 |
| 7 | 325 | 246 | 362 | 246 | 182 | 234 | 252 |
| 8 | 265 | 185 | 265 | 185 | 139 | 177 | 195 |
| 9 | 30 | 19 | 36 | 14 | 10 | 14 | 6 |
| 10 | 224 | 168 | 255 | 188 | 151 | 168 | 182 |
| 11 | 200 | 115 | 231 | 128 | (77) | 122 | 125 |
| 12 | 77 | 38 | 84 | 36 | 33 | 37 | 46 |
| 13 | 111 | 64 | 126 | 64 | 52 | 76 | 25 |
| 14 | 114 | 66 | 138 | 56 | 38 | 76 | — |
| 15 | 83 | 68 | 97 | 61 | 62 | 64 | 77 |
| 16 | 259 | 157 | 283 | 155 | (105) | 158 | 164 |
| 17 | 245+ | 132+ | 378+ | (238) | 167 | 233 | 238 |
| 18 | 9+ | 9+ | 11+ | 7+ | 9 | 9 | 10 |
| 19 | — | 9+ | 10+ | 9 | 9 | 8 | 10 |
| 20 | (87) | (77) | 107 | 63 | 50 | 59 | 70 |
| 21 | — | — | 80+ | 28+ | 22 | 40 | 36 |
| 22 | — | — | 147+ | 89 | 56 | 87 | 93 |
| 23 | — | — | 147+ | — | 56 | 87 | 91 |
| 24 | 136 | 108 | 142 | 120 | 76 | 103 | 119 |
| 25 | 26 | 6 | 104 | 40 | 0 | 38 | 34 |

( ) Denotes approximate measurement.

TABLE 42:

A comparison of features which distinguish *Kogia breviceps* from *Kogia simus*, after Handley (1966), with measurements from Ross (1979 and present study).

| Feature | *K. breviceps* | *K. simus* |
|---|---|---|
| MAXIMUM LENGTH | *c.* 3,3 m | *c.* 2,7 m |
| DORSAL FIN HEIGHT (per cent of total length) | x̄ = 3,8%, N = 15<br>(2,3 – 5,3%) | x̄ = 7,4%, N = 25<br>(5,4 – 10,0%) |
| SHAPE OF SNOUT in lateral view | Rectangular and bulbous in adults | Squarish in adults |
| MAXIMUM CONDYLOBASAL LENGTH | *c.* 470 mm | *c.* 320 mm |
| DORSAL CRANIAL FOSSAE | Not cupped posteriorly, left fossa longer and narrower than right | Cupped posteriorly and sub-symmetrical |
| DORSAL SAGITTAL SEPTUM near vertex | Broad, in adults<br>(23 – 49 mm, N = 19) | Narrow, often pinched posteriorly<br>(5 – 20,5 mm, N = 30) |
| MANDIBULAR SYMPHYSIS | Long and ventrally keeled<br>(68 – 128 mm in adults, N = 11) | Short, may be ventrally keeled<br>(22 – 51 mm, N = 21) |
| NUMBER OF MANDIBULAR ALVEOLI | x̄ = 13,6, N = 8<br>(12 – 16) | x̄ = 9,6, N = 20<br>(7 – 12) |
| NUMBER OF MAXILLARY TEETH | None | None, or one to three pairs |
| MAXIMUM TOOTH LENGTH and diameter | 47 mm, 9 mm | 26 mm, 4 mm |

The vertebrae formulae of two specimens from this region are PEM 1520/14 – C7 T13 L10 Cd17 (+3?) = 47 (+3), and PEM 1520/22 – C7 T12 L12 Cd21 (+1) = 52 (+1). The relatively low number of vertebrae in the former whale is similar to that in a Uruguayan specimen (C7 T13 L10 Cd21 = 51) (Vax-Ferreira and Praderi, 1973), although these authors suggest that ossification of the terminal caudals may have been incomplete in their specimen. The vertebral formulae of six South Australian specimens (Hale, 1962; 1963) were C7 T12–14 L9–10 Cd23–26 = 52–55. The number of lumbar vertebrae in PEM 1520/22 is unusually high for this species although the number of caudals is correspondingly lower.

### BIOLOGY

*Age determination:* Teeth were available for sectioning from PEM 1520/13 and PEM 1520/22. Ross (1979) examined sections of teeth from 15 other southern African *K. breviceps*. The pattern of deposition in *Kogia* teeth resembles that of the sperm whale *Physeter macrocephalus* in which dentine is deposited forming a chevron pattern in longitudinal section and with rare exceptions the pulp cavity appears to remain open throughout life. In the 15 previously examined specimens alternating opaque and translucent laminae forming layers were visible in the teeth, but the distinctness of these varied considerably between and within growth layers. In some teeth the dentine was almost uniformly translucent and growth layers were distinguished by the presence of thin refractive lines in a position corresponding to the junction of two layers.

The teeth of PEM 1520/13 had large pulp cavities extending 50 per cent of the length of the tooth. The largest of 23 available teeth was 32 mm long and 5 mm in diameter. Three complete layers and one incomplete layer were counted in the dentine. The most recently deposited material was opaque in transmitted light and was estimated to be approximately 50 per cent of the width of the completed layers.

All of the 19 available teeth of PEM 1520/22 had closed pulp cavities. The largest of these teeth was 47 mm long, measured in a straight line, and 8 mm in diameter. At least 19 layers were counted in the dentine although they were not well defined. As the tip of this tooth was worn and the base consisted of non-laminated nodular dentine this count is considered to be a minimum one. The vertebral epiphyses of this specimen were fused to their centra, indicating physical maturity.

*Growth and development:* The length at birth (*c.* 1,2 m) and length at physical maturity (*c.* 3,0–3,3 m) were estimated from all available data (Ross 1979). A growth curve based on 15 southern African *K. breviceps* and changes in the external and skull proportions with age in this species have also been plotted and discussed in that paper. Measurements of the most recent material support the conclusions reached previously. PEM 1520/22 was physically mature at a length of 3,04 m. The ages and lengths of PEM 1520/13 and PEM 1520/22 fit reasonably well onto the growth curve plotted before.

The external measurements provided in Table 40 support the suggestion that there is little change in body proportions with an increase in length in *K. breviceps*. Skull measurements (Table 41) confirm the previous findings that the skull becomes proportionately longer and narrow with age, essentially through an increase in the length of the rostrum and mandible tips.

The total mass of PEM 1520/13 and 1520/14 was 301 kg and 130 kg respectively.

*Reproduction:* Details of the ovaries of PEM 1520/13 and 1520/14 are provided in Table 43. The single corpus luteum in the ovary of PEM 1520/13 is presumed to have formed from

TABLE 43:

Ovarian data for two *Kogia breviceps* and three *Kogia simus* from the SE coast of southern Africa.

| Catalogue Number | Total length (mm) | Ovarian | | Corpus luteum diameter (mm) | Corpora albicantia diameter (mm) and index | Comments |
|---|---|---|---|---|---|---|
| | | Dimensions (mm) | Mass (g) | | | |
| *K. breviceps* | | | | | | |
| PEM 1520/13 | 2 660 | 59×23×10 | 12,9 | 28×27×15 | 0 | Corpus luteum mass 7,2 g. Numerous follicles up to 3 mm diameter. |
| | | 46×27×11 | 7,3 | 0 | 7 (245) | Ovary surface smooth. Numerous follicles up to 3 mm diameter. |
| PEM 1520/14 | 2 040 | 25×14×03 | 0,8 | 0 | 0 | Ovary smooth. |
| | | 20×10×05 | 0,8 | 0 | 0 | Ovary smooth. |
| *K. simus* | | | | | | |
| PEM 1520/67 | 1 470 | 22×10×07 | 0,9 | 0 | 0 | Ovary smooth. |
| | | 21×11×05 | 0,9 | 0 | 0 | |
| PEM 1520/66 | 2 200 | 32×22×12 | 4,9 | 0 | 0 | Ovary smooth. Follicles up to 2 mm diameter. |
| | | 35×21×15 | 6,0 | 0 | 5 (80) | No surface scar. Lactating; calf 1,47 m. |
| ELM 935 | 2 500 | 40×27×18 (R) | 10,1 | 27×18×25 | 0 | Corpus luteum mass 7,6 g. Foetus 960 mm in length. |
| | | 30×14×10 (L) | 2,3 | 0 | 0 | Follicles up to 1 mm diameter. |

the corpus luteum of pregnancy associated with the calf PEM 1520/14. The lack of further corpora suggests that this female had recently attained sexual maturity. Although she is the smallest specimen (2,665 m) of *K. breviceps* known to be sexually mature the number of dentine layers in the teeth (*c.* 3,5) is still surprisingly low. Allowing that the calf PEM 1520/14 was at least several months old and that its gestation period had been several months, the adult female presumably conceived for the first time about one year or perhaps two years prior to stranding. If each dentine layer represents one year's growth, this female was about two years old when she first conceived. Clearly further information, particularly on age determination, is required to resolve this question.

The mean length of females at sexual maturity is estimated to be between 2,7 m and 2,8 m. The gestation period is unknown as records of foetuses and newborn calves are too scattered through the year to indicate a foetal growth rate or a calving season (Ross, 1979).

The mammary gland of PEM 1520/13 was still producing some milk which suggests that the calf was not entirely weaned. The mammary gland of PEM 1520/22 contained a small quantity of a viscous, pale brown fluid.

Data from the few males that have been examined suggest that they become sexually mature when between 2,7 m and 3,0 m in length (Ross, 1979).

*Food and feeding:* Stomach contents were collected from all three *K. breviceps* examined since 1975. Cephaloped beaks formed the major component of the contents in each stomach. The identifications of these beaks are provided in Table 44. All of these cephalopods have been recorded from southern African *K. breviceps* before.

The stomach of PEM 1520/22 contained nine fish otoliths identified as those of *Photichthys argenteus* (5), *Symbolophorus* cf. *boops* (2), *Maurolicus muelleri* (1) and *Lampanyctus* sp. (1). This stomach also contained a single carapace, 67 mm in length, of the mysid *Gnathophausia*.

The stomach of PEM 1520/14 contained the remains of eight small *Pyrosoma*, but most of the stomach was filled with a paper bag and eight polythene bags (four transparent, two white and two blue in colour).

*Parasites:* Nematodes collected from the stomach of PEM 1520/22 were identified as *Anisakis simplex, A. physeteris* and *Phocanema kogiae*. Immature specimens of *Anisakis* were found in the stomach of PEM 1520/13.

Larval cysts of the cestode *Phyllobothrium delphini* were found in the blubber of PEM 1520/13 and similar cysts were noted in PEM 1520/22.

### Distribution and migration

*K. breviceps* is a widely distributed species recorded most frequently from strandings on the coasts of southern Africa, south-eastern Australia, New Zealand and south-eastern United States (Handley, 1966).

In southern African waters records extend from Cape Cross, in South West Africa, to Natal. The majority of records are for the south western and eastern Cape coasts, probably reflecting the distribution of interested observers rather than the actual abundance of this species in these areas (Ross, 1979; present study).

The seasonal occurrence of 34 dated records of *K. breviceps* from southern Africa does not suggest that this species is absent or more abundant in any particular season, at least on the Cape coasts for which there are a reasonable number of records.

## ***Kogia simus*** (Owen, 1866)
## Dwarf Sperm Whale

*Euphysetes simus* Owen, 1866: 30 (holotype, skull, BM 1474c–73.6.25.2; type locality, Waltair, Madras, India).
*Kogia simus* Yamada, 1954: 37; Best, 1971: 3 (identification). Ross 1979: 259 (new records).

Table 44:
Numbers of lower beaks of cephalopods from three stomachs of *Kogia breviceps* and four stomachs of *Kogia simus* from the SE coast of southern Africa.

| Cephalopods | *K. breviceps* | | | *K. simus* | | | |
|---|---|---|---|---|---|---|---|
| | PEM 1520/13 | PEM 1520/14 | PEM 1520/22 | PEM 1520/66 | PEM 1520/67 | PEM 1520/72 | PEM 1520/89 |
| HISTIOTEUTHIDAE | | | | | | | |
| Type 1 | | | 6 | | | | |
| Type 2 | | | 24 | 1 | 8 | 6 | |
| Type 3 | | | 7 | | | | |
| Type 4 | | | | | | 2 | |
| Type 7 | | | 1 | | | | |
| Unclassified | | | | | 2 | | |
| ENOPLOTEUTHIDAE | | | | | | | |
| *Ancistrocheirus* | | | 1 | | | | |
| *Abralia* | | | | | | | 1 |
| LYCOTEUTHIDAE | | | | | | | |
| *Oregoniateuthis* | | | 19 | | | 4 | |
| CRANCHIIDAE | | | | | | | |
| *Taonius* | | | | | | 1 | |
| *Pyrgopsis* | | | | | | 1 | |
| Type 1 | | | | | | 2 | |
| Type 2 | | | 16 | | | | |
| OMMASTREPHIDAE | | | | | | | 2 |
| CHIROTEUTHIDAE | | | | | | | |
| Type 1 | | | 1 | | 1 | | |
| Type 3 | | | 2 | | 1 | | |
| ONYCHOTEUTHIDAE | | | | | | | |
| *Moroteuthis* | | | 1 | | | | |
| LOLIGINIDAE | 12 | 17 | 1 | | | | |
| SEPIIDAE | | 9 | | | 27 | | 65 |
| OCTOPODIDAE | 26 | 2 | | | | | |
| Unidentified | | | | | 3 | | |

## Records and material

Prior to 1976, 32 strandings of *K. simus* representing 42 animals had been recorded on the southern African coast; 30 of these whales stranded on the SE coast (Ross, 1979). Details of four subsequent strandings are provided in Table 39.

## Specific status and characters

The specific status of *K. simus* was established by Handley (1966) following studies by Ogawa (1936) and Yamada (1954). Features which distinguish *K. simus* from *K. breviceps* are compared in Table 42 using data from southern African specimens (Ross, 1979; present study).

In external appearance this species is characterised by its small size, a maximum length of about 2,7 m, by the shape of the snout which is squarish in profile in adult specimens and by the height of the dorsal fin which is more than 5 per cent of body length.

## Description

An adult female PEM 1516/97, 2,35 m in length, is illustrated in Fig. 14.

The body of *K. simus* is robust and full-bellied, reaching its maximum girth at mid-length of the body. It is slightly compressed laterally in the anterior half, becoming progressively more compressed towards the flukes.

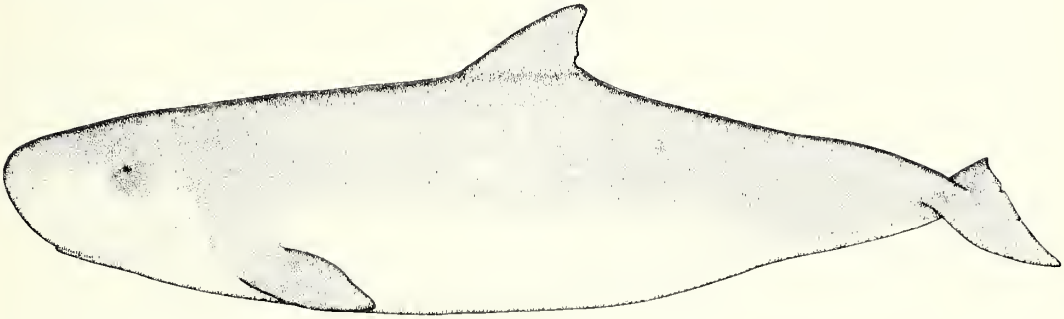


Fig. 14. Adult female *Kogia simus*, 2,35 m in length, from the eastern Cape (PEM 1516/97).

In juvenile specimens the snout is pointed and its dorsal surface is inclined antero-ventrally as in juvenile *K. breviceps*. With age the snout becomes blunt and squarish in profile. The mouth is small and set with seven to 12 pairs of slender, needle-sharp mandibular teeth which are curved and directed posteriorly.

The flippers are moderately long and broad. Both margins are convex, especially the upper one, and taper to a rounded apex. The dorsal fin resembles that of delphinids. It is high, relatively broad-based, with convex leading edge and concave trailing edge. It is placed at about mid-length of the body. The flukes are broad and tapered laterally and, as in *K. breviceps*, are typically less resilient to flexing than the flukes of a delphinid.

External measurements of five *K. simus* and one foetus are provided in Table 40.

The colour pattern of *K. simus* is very similar to that of *K. breviceps*. The major features of the pattern are clear in Fig. 14 which illustrates a specimen examined a few minutes after death. This animal stranded and died after dark and virtually no changes in colour tones are thought to have occurred before examination. The dorsal surfaces of the head, body, dorsal fin and upper surface of the flukes were very dark grey which became paler laterally and merged smoothly into the white colour of the ventral surface. A patch around each eye and the outer surface of the flippers were intensely dark greyish black. The ventral surfaces of the flippers were the same colour as that of the body. The ventral surface of the flukes was pale grey gradually becoming dark grey at the tips of the flukes.

The rostrum is proportionately shorter in *K. simus* than in any other living cetacean (Handley, 1966). Its breadth at the base ($\bar{x}$ 45,2 per cent CBL, limits 39,6–53,5 per cent CBL) is greater than its length ($\bar{x} = 36,2$ per cent CBL, limits 28,5–41,5 per cent CBL) ($n = 29$) at all ages (Ross, 1979; present study). The cranial fossae are similar in shape and size and become deeply cupped in older specimens. The sagittal septum at the vertex is narrow with near-vertical walls and may be pinched laterally at its posterior end. Skull measurements of four *K. simus* are provided in Table 41.

The vertebral formulae of ten *K. simus* from southern Africa are listed in Table 45. The range of these formulae is C7 T12 − 13 L10 − 14 Cd 22 − 26 = 53 − 56. Almost the entire

Table 45:

Variation in the vertebral formulae of ten *Kogia simus* from the SE coast of southern Africa.

| Catalogue Number | Vertebrae | | | | |
|---|---|---|---|---|---|
| | Cervical | Thoracic | Lumbar | Caudal | Total |
| PEM 1518/85 | 7 | 13 | 10 | 19 (+3) | 49 (+3) |
| PEM 1519/59 | 7 | 12 | 11 | 24 | 54 |
| PEM 1519/60 | 7 | 13 | 12 | 21 (+1) | 53 (+1) |
| PEM 1519/61 | 7 | 13 | 12 | 23 | 55 |
| PEM 1519/62 | 7 | 13 | 11 | 20 (+1) | 51 (+1) |
| PEM 1519/72 | 7 | 13 | 14 | 20 | 54 |
| PEM 1519/73 | 7 | 13 | 10 | 26 | 56 |
| PEM 1520/66 | 7 | 12 | 12 | 23 | 54 |
| PEM 1520/67 | 7 | 12 | 12 | 22 | 53 |
| PEM 1520/89 | 7 | 12 | 11 | 24 | 54 |

(   ) denotes estimated number of missing vertebrae.

range of variation is shown by the formulae of four specimens which stranded together (PEM 1519/59, 60, 61 and 62). The formulae of specimens from the North Atlantic (Allen, 1941) and South Australia (Hale, 1962) fall within the range of variation shown by southern African specimens. Specimens from Japan however seem to have a slightly greater number of vertebrae. Three specimens examined by Yamada (1954) had 57 vertebrae, while a fourth had 54 vertebrae.

## Biology

*Age determination:* Attempts to age specimens of *K. simus* from counts of dentine layers have so far proved unsuccessful (Ross, 1979) owing to the poor contrast between and within growth layers. Sections of teeth from PEM 1520/66 and ELM 935 also proved difficult to count and further attempts at ageing have been deferred. In these two specimens layers are visible in the cement layer which may offer a better means of ageing than the dentine in future studies.

The pulp cavities of PEM 1520/66 and ELM 935 were both closed for more than 90 per cent of the length of tooth. Both animals were sexually mature but not yet physically mature.

*Growth and development:* The length at birth in *K. simus* is not known. The smallest calf of known length was 1,36 m long (PEM 1516/51). By comparison with *K. breviceps* the length at birth has been estimated to be about 1 m in length (Ross, 1979).

The maximum length attained is about 2,7 m in this species. Lengths of physically mature animals, however, show considerable variation. Two physically mature North Atlantic specimens measured 2,21 m and 2,44 m (Allen, 1941; Tomilin, 1957) and three southern African specimens were 2,47 m, *c.*2,54 m and *c.*2,68 m in length.

There appears to be little change in the proportions of the body in *K. simus* individuals of more than 1,36 m in length. The rostrum of the skull and mandible tips, however, increase slightly in proportion with increasing body length (Ross, 1979; present study).

Total and some partial body masses for three southern African *K. simus* are provided in Table 46. The kidneys of PEM 1520/89 weighed 265 g and 285 g, and the liver and pancreas 2140 g and 45 g respectively. The small intestine of this specimen was 22,0 m (12,9 × body length) and the large intestine was 4,8 m (2,8 × body length) in length. The mammary glands of PEM 1520/66 weighed a total of 620 g. The 960 mm foetus of ELM 935 weighed 12,9 kg.

Table 46:

Total and partial body mass for three *Kogia simus* from the SE coast of southern Africa. Partial masses are expressed as percentages of total mass (kg).

| Catalogue Number | Total length (mm) | Total mass (kg) | Blubber | Meat | Heart, lung and trachea | Heart |
|---|---|---|---|---|---|---|
| PEM 1520/66 | 2 200 | 156 | 17,4 | 42,9 | 2,3 | 0,52 |
| PEM 1520/67 | 1 470 | 61,5 | 29,8 | 29,8 | 2,2 | 0,52 |
| PEM 1520/89 | 1 710 | 98,5 | 19,2 | 36,9 | 2,0 | 0,47 |

A length/mass relationship has been derived from measurements of length and mass of 13 *K. simus* from southern Africa (Ross, 1979; present study):

$$\log Y = -6{,}77 + 2{,}70 \log X \; (r = 0{,}89)$$

where Y = body mass (kg) and X = body length (mm).

*Reproduction:* Ovaries were collected from PEM 1520/66 and her calf, PEM 1520/67, and ELM 935. Details of dimensions and corpora counts are provided in Table 43. The two longer animals are sexually mature and from corpora counts appear to have ovulated recently for the first time. The length of PEM 1520/66 of 2,20 m agrees closely with the suggested length at sexual maturity in female *K. simus* of 2,1–2,2 m. However, ELM 935 with a length of 2,50 m is considerably longer than sexually immature females recorded previously and longer than most multiparous females (Ross, 1979).

The 960 mm foetus of ELM 935, stranded in December 1976, is thought to be close to term which suggests that it would have been born early in 1977. There are still too few records of foetuses, however, to provide information on the gestation period or on whether there are distinct breeding and calving seasons.

The length at weaning is not known with any accuracy. The 1,47 m calf PEM 1520/67 was suckling and eating solid food. This is consistent with previous observations of *K. simus* calves of about 1,4 m upwards which had solid food remains in the stomach. The 1,71 m animal PEM 1520/89 had been eating cephalopods and, though stranded alone, it may have been with a lactating female from which it had become separated.

The mammary gland of PEM 1520/66 was secreting milk copiously. Each gland was 520 mm long and up to 40 mm wide, tapered anteriorly and reached mid-length of the body.

One additional male *K. simus* PEM 1520/89 (1,71 m) was examined. the testes of this animal measured 120 mm × 22 mm and weighed 36 g and 37 g. The mean tubule diameter was 46 $\mu$ and spermatogenesis had not begun. Ross (1979) suggested that most males become sexually mature when between 2,1 m and 2,2 m in length.

*Food and Feeding:* The stomachs of all four specimens examined since 1975 contained cephalopod beaks which supports previous conclusions of Ross (1979) that cephalopods form the major prey of this species although the diet is supplemented with fish and some crustaceans. Identifications of 127 beaks from these four specimens are given in Table 44.

Each category of beak has been recorded previously from southern African *K. simus* stomachs, the contents of which also showed a similar predominance of sepiid beaks.

Comparison of the cephalopods in stomachs of unaccompanied adult *K. simus* ($>$ 2, 1 m TL; n = 6) with those of immatures ($<$ 2,1 m TL), calves and adult females accompanying them (n = 15) shows that the latter group captured a very high proportion of cephalopods which occur over the continental shelf (93 per cent of 1465 prey items), particularly small sepiids, while the adults caught more oceanic cephalopods (71 per cent of 142 prey items) (data from Ross, 1979; present study). In this comparison the shelf forms include loliginids, sepiids, octopodids, and *Oregoniateuthis* since this squid appears to be common over the edge of the continental shelf and upper part of the slope in eastern Cape waters (Ross, 1979); the remaining cephalopods are grouped as oceanic forms after Clarke (1966). Similarly, 85 per cent of 453 prey items from adult *K. breviceps* (> 2,6 m TL; n = 8) were oceanic forms compared with 55 per cent of 278 prey items in stomachs of immatures, calves and accompanying adult females (n = 7).

These differences suggest that juvenile and immature *Kogia*, particularly those of *K. simus*, live closer inshore than do adults, probably over the outer part of the continental shelf and upper part of the slope and that adults are found over deeper water, though how much further offshore is unknown. This interpretation differs from the previous conclusion that *K. breviceps* lives further offshore than does *K. simus* (Ross, 1979) which was based on a comparison of prey items in stomachs of all age groups of the two species. It is interesting to note that Mead (1979) also inferred that *K. breviceps* inhabited the continental shelf on the east coast of the United States based on high stranding frequencies of this species and other abundant inshore cetaceans.

The apparent shift in feeding habits from juvenile to adult in *Kogia* species may be linked with the change in the rate of growth of the mesorostral ossification which takes place at about the estimated length at sexual maturity (Ross, 1979). The mesorostral ossification has been implicated as a wave guide in the transmission of sounds used in echolocation (Norris, 1975) and it is possible that functional changes in these animals' echolocation occur at this time in conjunction with an offshore movement.

*Parasites:* Nematodes were present in the three stomachs examined for them. PEM 1520/66, PEM 1520/67 and PEM 1520/89 contained numerous specimens of *Anisakis simplex, A. physeteris* and *Phocanema kogiae.*

Cestode cysts found in the caudal blubber of PEM 1520/66 were identified as *Phyllobothrium delphini* larvae. A single cyst was seen in the blubber of PEM 1520/89.

*School size:* Extremely little is known of the behaviour of either species of *Kogia* because they are so rarely seen at sea. *Kogia* are reported to have an inconspicuous blow and to surface slowly showing only the back when breathing (Leatherwood *et al.*, 1972).

A summary of available data suggested that the school size of *K. simus* is probably ten or less, that females with calves may group, that immatures can form groups and that sexually mature males and females may be found in the same school (Ross, 1979).

## Distribution and Migration

*K. simus* is widely distributed in tropical and temperate waters. Handley (1966) records this species off southern Africa, India, Ceylon, Japan, central eastern United States, Hawaii and South Australia.

Southern African records of *K. simus* extend from Salhanha Bay (33° S, 18° E) to East London (33° S, 28° E). Most of the records (72 per cent) are from the SE coast. The complete absence of records from the coast north of Saldanha Bay and northeastward of East London may reflect the true distribution of this species, though stranding records of all cetaceans are numerically poor on these coasts. It has been suggested that the distribution of *K. simus* may be associated with the mixed water region formed by the interaction of the Agulhas and Benguella Current systems (Ross, 1979).

If, as seems likely from available data, the continental shelf or slope is important as a 'nursery' area for immature *Kogia* off southern Africa, it may partially account for the close correlation between the distribution of *K. simus* between Saldanha Bay and East London and the breadth of the shelf between these localities forming the massive Agulhas Bank. A similar correlation between this region and the wider distribution of *K. breviceps* is not as clear. Six of the 41 records of this species given by Ross (1979) are from localities outside this region. However, the distribution of all of these specimens of *K. breviceps* considered immature on body length or skull length is similar to that of *K. simus*, perhaps indicating that adult *K. breviceps* disperse more widely after moving offshore.

The dates of the four strandings in this report support the evidence from 27 southern African records reported previously that *K. simus* is present in eastern Cape waters throughout the year. There is also no indication that this species is more abundant at any particular season.

## Family DELPHINIDAE

These are small to medium-sized whales of adult length 1,4–9,0 m. This family contains a heterogeneous assemblage of genera characterized by the fusion of the first two cervical vertebrae.

The head of the larger forms (Globicephalinae of Fraser and Purves, 1960) and of the porpoises (Phocaeninae) is globose and has little or no beak. The 'typical' dolphins (Delphininae of Kasuya, 1973, and of other authors) have a slender rostrum of variable length. Teeth are present in both jaws (upper teeth absent in *Grampus*) and vary in number from three pairs to 65 pairs. The dorsal fin may be triangular, falcate, high, low or absent (*Lissodelphis*).

The suprageneric classification of forms included in this family by Rice and Scheffer (1968) has still to be resolved satisfactorily. Subfamilial-divisions have not been used in the present report owing to these difficulties. However, the sequence in which the genera are treated approximates the groupings made by the authors quoted below. *Grampus* has been placed between the preceding blunt-headed forms and *Tursiops* for, though Fraser and Purves (1960) demonstrated the similarity in the air-sac systems of *Tursiops* and *Grampus*, Kasuya (1973) has shown that the tympano-periotic bones of *Grampus* are allied to those of *Globicephala, Feresa* and *Peponocephala. Sousa* has been placed at the end of the list since it is uncertain whether it should be placed in a separate family with *Steno* (Stenidae of Fraser and Purves, 1960) or if it belongs in the family Delphinidae. Kasuya (1973) retained *Sousa* in the subfamily Sotaliinae of the Delphinidae together with another coastal genus *Cephalorhynchus* and the fluviatile genus *Sotalia*.

### **Genus *Orcinus* Fitzinger,** 1860

*Wissentchaftlich-populäre Naturgeschichte der Säugerthiere*, 6: 204; type species *Orcinus orca* (Linnaeus) by monotypy.

Adult males attain 9 m in length. The head is rounded, depressed and has a very short, broad rostrum. There are 10 to 13 teeth in each jaw; each tooth is characteristically compressed antero-posteriorly. The dorsal fin is well-developed, particularly in the male. The flippers are large, broad and rounded distally. The colour pattern is distinctive, as described below. *Orcinus* differs karyotypically from all other cetaceans examined to date, though further studies are required to evaluate the significance of these findings (Kulu. *et al.*, 1971).

A single species, *Orcinus orca*, is currently recognized.

### ***Orcinus orca*** (Linnaeus, 1758)
### Killer Whale

*Delphinus orca* Linnaeus, 1758: 77 (type description based on the common killer whale of authors; type locality, "Oceano Europaeo").
*Delphinus victorini* Grill, 1858: 21 (type locality Knysna)
*Grampus gladiator* Smith, 1834: 238; Layard, 1862: 82
*Orca capensis* Gray, 1846: 34 (type locality Cape of Good Hope).
*Orca australis* Van Beneden and Gervais, 1869–1871: 47 (type locality Algoa Bay)
*Orca africana* Gray, 1871: 91 (new name for *Orca australis*)
*Orcinus orca* Palmer, 1899: 23–24; Sclater, 1901: 198; FitzSimons, 1920: 223; Roberts, 1951: 225; Ellerman, Morrison-Scott and Hayman, 1953: 331; Barnard, 1954: 23; Best, 1971: 5; Best and Ross, 1977: 494.

### Records and material

Data for eight specimens recorded from the S E coast of southern Africa are provided in Table 47. Between 1971 and 1975 Union Whaling Co., Durban took 36 *O. orca* in Natal waters (Best and Ross, 1977). Material from these animals will be studied by Dr Best, Sea Fisheries Branch. The localities and dates of 11 sight records of *O. orca* observed on whale marking cruises and in Algoa Bay by experienced observers are given in Table 48. Localities of sight records and stranded specimens are plotted in Fig. 32.

Table 47:

Records of specimens of *Orcinus orca* from the SE coast of southern Africa.

| Catalogue Number | Sex | Total length (mm) | CBL (mm) | Date | Locality | Comments |
|---|---|---|---|---|---|---|
| A–3 209 | — | — | — | 1837 | Algoa Bay | Skull of juvenile in Paris Museum. coll. by M. Verreaux (Dr van Bree, *in litt.*). |
| — | — | — | — | 10.06.1854 | Knysna district | Type specimen of *Delphinus victorini*. |
| — | — | — | — | before 1869 | Algoa Bay | Type specimen *Orca australis*. |
| — | — | — | — | before 1901 | Plettenberg Bay | Skull found in a cave. Now in SAM. |
| PEM 1514/07 | — | — | 987 | October 1952 | Gamtoos River Mouth | Whole skeleton and photographs in PEM. |
| PEM 1514/46 | — | — | — | *c*. 1965 | Gouritz River Mouth | Bleached partial cranium and mandible. |
| PEM 1518/74 | ♂ | 2 270 | 442 | 05.09.73 | Seaview, Port Elizabeth | Skull in PEM. |
| PEM 1520/40 | ♂ | 6 050 | 1 005 | 08.01.77 | Kings Beach, Port Elizabeth | Skull in PEM. Skeleton awaiting collection. |

### Specific status and characters

*O. orca* shows marked sexually dimorphic, age-related variations in the form and size of the flippers and dorsal fin and variations in colour pattern (Tomilin, 1957). Together with the

Table 48:

Sight records of *Orcinus orca* observed on whale-marking cruises (IOS, 1969, 1972, 1973, 1975) and in Algoa Bay by experienced observers.

| Date | Number | Locality |
|---|---|---|
| 22.08.69 | 3 | 29° 32′S, 32° 08′E |
| 24.08.69 | 8 | 29° 44′S, 33° 03′E |
| 31.08.69 | 12 | 30° 28′S, 32° 46′E |
| 09.02.72 | 10 | 31° 27′S, 30° 59′E |
| 16.05.72 | 3 | 33° 59′S, 25° 41′E |
| 08.02.73 | 2 | 33° 23′S, 29° 12′E |
| 10.02.73 | 10 | 34° 00′S, 27° 53′E |
| 14.02.73 | 5 | 34° 42′S, 27° 21′E |
| 25.01.75 | 11 | 35° 54′S, 23° 48′E |
| 27.01.75 | 5-10 | 35° 16′S, 24° 54′E |
| 13.04.77 | 2 | 33° 52′S, 25° 43′E |

cosmopolitan distribution of these animals the variations led early taxonomists to name a large number of different species of *Orcinus*, including at least two species from southern Africa. It is now generally accepted that *Orcinus* is monotypic although no comprehensive taxonomic revision of the genus has been published. True (1889) omitted discussion of *Orcinus* in his revision of the Delphinidae because he wished to avoid increasing the confusion concerning the number of species. True (1904) noted that the available data indicated a single species in the North and South Atlantic but that animals from the South Pacific and possibly those from the North Pacific might prove to be distinct species.

Owen (*in* Gray, 1866) pointed out that the slight differences in the skulls of *Orca capensis* and the North Atlantic *Orca gladiator* were merely intraspecific variations, not specific differences, though Gray (1866) maintained them as separate species. Comparison of the external and skull measurements of the southern African material examined in this study (Tables 49, 50) with those of *Orca capensis* (Gray, 1866) and a synopsis of data on North Atlantic specimens (Tomilin, 1957) did not indicate any differences of a specific nature and support the accepted view that killer whales from these populations belong to the same species.

### DESCRIPTION

The external features of a 6,05 m long adult male, PEM 1520/40, are illustrated in Fig. 15 and external measurements are provided in Table 49.

The body of *O. orca* is robust and rounded in transverse section. There is little lateral compression of the body except on the posterior part of the caudal peduncle. The head is slightly compressed dorso-ventrally. In the adult male illustrated in Fig. 15 a short, very broad beak was present but in the calf PEM 1518/74 the beak was less well defined.

The flippers are very broad, paddle-shaped structures which increase in length with age from about 12 per cent body length in juveniles to about 22 per cent body length in adults of both sexes (present study; Tomilin, 1957). The dorsal fin is set slightly anterior to the mid-length of the body. It is higher than its base length in animals older than nursing calves and increases in height with age. In adult males the dorsal fin may reach 1,6 m (up to 22 per cent

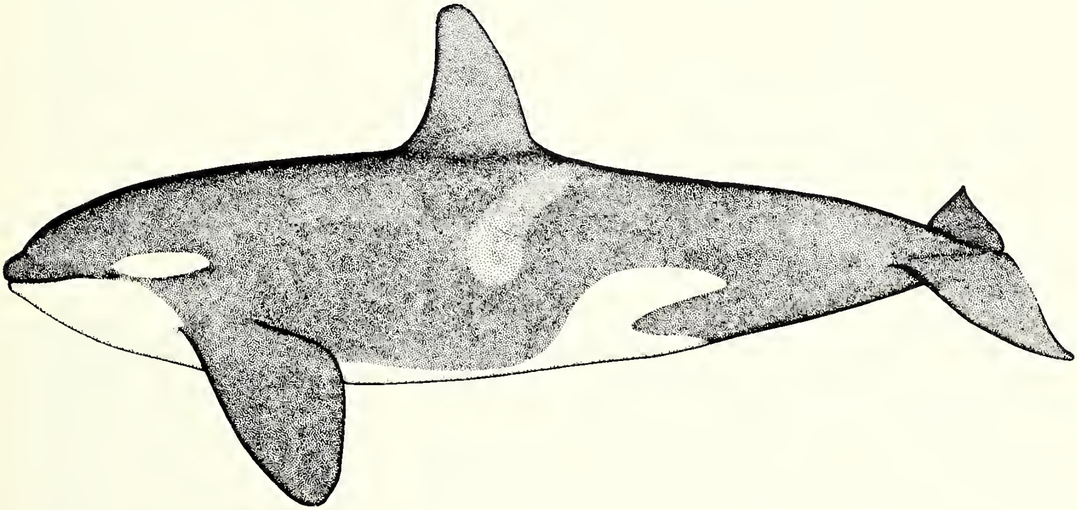


Fig. 15. Adult male *Orcinus orca*, 6,05 m in length, from the eastern Cape (PEM 1520/40).

TABLE 49:

External measurements in mm of two *Orcinus orca*, one *Pseudorca crassidens* calf and two *Feresa attenuata* from the SE coast of southern Africa. Measurement numbers are keyed to Table 2.

| | *O. orca* | | *P. crassidens* | *F. attenuata* | |
|---|---|---|---|---|---|
| Measurement Number | PEM 1518/74 | PEM 1520/40 | PEM 1520/76 | PEM 1515/41 | PEM 1515/42 |
| 1 | 2 270 | 6 050 | 1 670 | 2 640 | 2 440 |
| 2 | 250 | 660 | 220 | 280 | 280 |
| 3 | 0 | 200 | — | — | — |
| 4 | 225 | 550 | — | 205 | 205 |
| 7 | 55 | 110 | — | 75 | 75 |
| 8 | 270 | 580 | — | 205 | 205 |
| 9 | 250 | 730 | 220 | 305 | 290 |
| 10 | 490 | 1 080 | 330 | 535 | 535 |
| 11 | 1 070 | 2 300 | 770 | — | — |
| 12 | 1 350 | 2 550 | 930 | 1 450 | 1 475 |
| 13 | 1 100 | 2 600 | — | 1 120 | 1 065 |
| 14 | 1 410 | 3 700 | (1 106) | 1 370 | 1 395 |
| 15 | 1 590 | 4 250 | — | 1 675 | 1 625 |
| 16 | −20 | −40 | — | −40 | −50 |
| 18a | 45 | 105 | — | — | — |
| b | 25 | 62 | — | — | — |
| c | 35 | 82 | — | — | — |
| 20 | 1 180 | 3 460 | — | — | — |
| 21 | — | 3 900 | — | — | — |
| 22 | 740 | 2 740 | — | 915 | 865 |
| 23 | 15 | — | — | — | — |
| 25a | 145 | 600 | — | 65 | (100) |
| b | 10 | 150 | — | — | — |
| 26 | 48 | — | — | 50 | 55 |
| 27 | 350 | 1 350 | 205 | 480 | 455 |
| 28 | 220 | 1 160 | 140 | 355 | 340 |
| 29 | 140 | 850 | 75 | 150 | 160 |
| 30 | 165 | 1 160 | 80 | 255 | 255 |
| 31 | (290) | 900 | 150 | 510 | 485 |
| 32 | 435 | 2 180 | 250 | 635 | 660 |
| 33 | 165 | 680 | 102 | 165 | 180 |
| 34 | (30) | 200 | 15 | 50 | 50 |

( ) denotes approximate measurement.

body length) in height. The fin of the adult female is lower and does not exceed 1 m (up to 14 per cent body length) in height (Tomilin, 1957). The flukes are broad and powerful with a well-formed median notch. The width of the flukes increases with age in males only (Tomilin, 1957).

The contrasting black and white colour pattern of the killer whale is distinctive (Fig. 15). In PEM 1520/40 the ventral surface of the flipper was black, that of the flukes was white edged with black on the posterior border and lateral tips and the area around the caudal notch was streaked lightly with sepia markings which extended laterally between the black border and the white undersurface. The grey saddle mark behind the dorsal fin was barely visible in this animal, though it was examined after it had lain submerged overnight, in which time darkening of the area could have occurred.

The colour of the calf PEM 1518/74 was similar to that of the adult male, though the throat and ventral surface of the flukes were yellowish in colour. It is probable that this colour was due to diatom fouling, as noted by Tomilin (1957), since the skin appears white in colour slides of areas where it has been scraped by rocks. There was no discernible pale dorsal saddle mark, though this animal was examined after several hours exposure to the sun.

The white, ovate post-ocular spot has been present on all southern African specimens and sighted animals examined by the author. The grey dorsal saddle was distinct on adult males seen on 9 February 1972 and 13 April 1977 and on a female or subadult male sighted on 25 January 1975 (Table 48).

In the group of eight animals seen on 24 August 1969, the grey saddle was present in all but one whale which was entirely black posterior to the dorsal fin. The grey colour of this area appears to be characteristic of *O. orca* on the SE coast of southern Africa and indicates that this population is probably distinct from those of the Antarctic (Tomilin, 1957; photographs in Gaskin, 1968a and Mitchell, 1973) and those around the Prince Edward Islands Southern Ocean (photographs in PEM files, and Condy and van Aarde, 1977) in which the dorsal saddle is white.

The rostrum of the skull is relatively short and wide and is composed largely of massive maxillary bones. The large temporal fossae are characteristic of *O. orca* and, together with the large areas for attachment of masticatory muscles on the massive mandibles, indicate the predatory nature of these animals. The teeth are large, strong and flattened antero-posteriorly and are set in deep alvieoli. There are 10 to 13 teeth in each jaw. The upper and lower teeth interlock causing wear on their anterior and posterior surfaces. In extreme cases the teeth may be worn flat to the level of the gums (Caldwell and Brown, 1964) as was the case in PEM 1520/40.

Skull measurements of four southern African *O. orca* are provided in Table 50.

The vertebral formula of PEM 1514/07 is C7 T10 (+1) L11 Cd18 (+3) = 46 (+4). The first few cervical vertebrae of this physically mature animal were fused together. The last three lumbar and first three caudal vertebrae showed extensive erosions of their centra and transverse processes. The vertebral formulae of two other specimens of *O. orca* were C7 T11 L10 Cd22 or 23 = 50 or 51 (Gray, 1866), and C7 T12 L10 Cd21 = 50 (Tomilin, 1957). Nishiwaki (1963) gives an average formula of C7 T11 − 12 L10 Cd21 − 24 = 50 −52.

## BIOLOGY

*Age determination:* Teeth from three animals were available for sectioning. The best conditions for counting dentinal layers were provided by viewing the sections in reflected light against a black background.

The largest of 36 teeth collected from the calf PEM 1518/74 measured 28 mm in height. The basal diameters of this tooth were 21 mm and 16 mm. The tooth consisted of a hollow cone of dentine covered by a cap of enamel approximately 22 mm in height. The prenatal dentine of this tooth was approximately 1,1 mm thick near the apex of the pulp cavity. The neonatal line was well-marked and about 50 $\mu$ thick. A layer of opaque postnatal dentine, 290 $\mu$ thick, had been deposited on the inner surface of the tooth.

The teeth of the adult specimens PEM 1514/07 and PEM 1520/40 consisted almost entirely of dentine covered by a thin layer of finely layered cement between 0,5–1,0 mm in thickness. The postnatal dentine showed about 15 and 16 layers in PEM 1514/07 and PEM 1520/40 respectively before the pulp cavity was occluded by nodular, translucent secondary dentine which extended for 75 per cent of the tooth length in PEM 1514/07 and the entire length of the worn tooth of PEM 1520/40.

*Growth and development:* The length at birth in *O. orca* is uncertain. Tomilin (1957) suggested it was about 2,1–2,5 m, while Jonsgard and Lyshoel (1970) concluded that it must be close to 2,1 m. Nishiwaki and Handa (1958), however, indicated that *O. orca* from Japanese waters might be born at about 2,7 m in length. The presence of a distinct postnatal dentine lay-

TABLE 50:

Skull measurements in mm of four *Orcinus orca* from the SE coast of southern Africa. Measurement numbers are keyed to Table 6.

| Measurement Number | PEM 1514/07 | PEM 1514/46 | PEM 1518/74 | PEM 1520/40 |
|---|---|---|---|---|
| 1 | 987 | — | 442 | 1 005 |
| 2 | 510 | — | 198 | 497 |
| 3 | 278 | — | 131 | 303 |
| 4 | 297 | — | 118 | 327 |
| 5 | 268 | — | 107 | 282 |
| 6 | 107 | — | 45 | 110 |
| 7 | 643 | — | 245 | 681 |
| 8 | 687 | — | 258 | 640 |
| 9 | 483 | — | 230 | 550 |
| 10 | 550 | — | 262 | 628 |
| 11 | 472 | — | 229 | 560 |
| 12 | 136 | — | 77 | 135 |
| 13 | 597 | — | 284 | 654 |
| 14 | 210 | — | 109 | 228 |
| 15 | 355 | — | 240 | 382 |
| 16 | 12 | — | 11 | 12 |
| 17 | 12 | — | 11 | 12 |
| 18 | 411 | — | (150) | 433 |
| 19 | 415 | — | (155) | 425 |
| 20 | 223 | — | 166 | 428 |
| 21 | 429 | — | 168 | 427 |
| 22 | 13 | 12 | 10 | 12 |
| 23 | 13 | — | 10 | 12 |
| 24 | 387 | 355 | 164 | 403 |
| 25 | 382 | — | 160 | 403 |
| 26 | 392 | 364 | 170 | 412 |
| 27 | 392 | — | 170 | 420 |
| 28 | 788 | 813 | 345 | 842 |
| 29 | 214 | 245 | 104 | 228 |
| 30 | 183 | 172 | 64 | 192 |
| 31 | 231 | — | (130) | 277 |
| 32 | 167 | — | 87 | 167 |
| 33 | 195 | — | 74 | 209 |
| 34 | 323 | — | 175 | (375) |
| 35 | 76 | — | 60,5 | 70 |
| 36 | 76 | — | 60,5 | 70 |

( ) denotes approximate measurement.

er and the healed umbilicus of PEM 1518/74, 2,27 m in length, indicate that this calf was at least a few weeks old and therefore some growth should have occurred. Whereas it is possible that this animal was unusually small at birth, the very limited evidence suggests that southern African *O. orca* are born at lengths in the lower part of the range of values quoted above.

The total lengths of 24 male and 12 female *O. orca* landed at Durban are compared in Table 51 with data from whales caught in Japanese waters and NE North Atlantic. Though the modal lengths of both male and female *O. orca* from Natal waters appear to be greater than those of other regions, this probably results from deliberate selection of larger animals by the whaling gunners, who took killer whales on occasion but not at every opportunity. The slightly shorter maximum lengths attained by *O. orca* in Natal waters reflects the small size of this sample. Less than 1 per cent of males and females in the Japanese or NE North Atlantic samples

Table 51:

Total lengths in metres of *Orcinus orca* taken commercially.

| Region | Males | | | Females | | | Source |
|---|---|---|---|---|---|---|---|
| | Modal length | Limits | N | Modal length | Limits | N | |
| Japan | 6,4 | 2,7–9,4 | 320 | 6,1 | 3,6–8,2 | 247 | Nishiwaki and Handa (1958) |
| NE North Atlantic | 6,4 | 2,4–9,8 | 891 | 5,5 | 3,0–8,5 | 494 | Jonsgard and Lyshoel (1970) |
| Natal | 7,6 | 5,8–8,8 | 24 | 6,4 | 5,8–7,9 | 12 | Best and Ross (1977) |

exceeded 8,8 m and 7,9 m respectively (after Nishiwaki and Handa, 1958; Jonsgard and Lyshoel, 1970). In sum, the data suggest that these three populations have similar total length distributions.

No mass of *O. orca* was recorded in the present study. A length/mass relationship has been given by Bigg and Wolman (1975) for 32 specimens from the eastern Pacific.

*Reproduction:* No data on female *O. orca* were collected in the present study. Data for the testes of PEM 1518/74 and PEM 1520/40 are given in Table 56. The presence of some sperm in the epididymis but little spermatogenesis of the latter animal suggests that this whale was approaching full sexual maturity. The dimensions and weight of the testis are intermediate between those of an inactive male and of a mature male *O. orca* listed by Harrison *et al.* (1972). The length of PEM 1520/40 (6,05 m) is consistent with the suggestion that males attain sexual maturity at about 5,8 m in length (Jonsgard and Lyshoel, 1970).

*Food and feeding:* Two stomachs of *O. orca* were examined. The stomach of the calf PEM 1518/74 contained only a quantity of milk. The stomach of PEM 1520/40 was completey empty.

Few studies of feeding habits based on systematic stomach analyses have been made for *O. orca*, although tales of the voracity of this species are legion. Nishiwaki and Handa (1958) showed that *O. orca* taken in Japanese waters fed on fish, squids, dolphins, whales and seals in that order of preference. Their conclusion that larger specimens preyed on marine mammals to a greater extent was supported by a study of ten stomachs from *O. orca* taken along the west coast of North America (Rice, 1968). In Antarctic waters cetaceans and pinnipeds, especially crabeater seals, are the major prey animals (Yukhov *et al.*, 1975).

*Injury and tooth wear:* During dissection of the head of PEM 1520/40 a healed slit-like injury about 100 mm in length was noticed on the right upper lip about 200 mm from the tip of the upper jaw. It was not considered significant until dissection of the postero-lateral part of the mandible revealed a large pus-filled abscess about half way between the condyle and the posterior end of the tooth row and just above mid-depth of the mandible. The abscess contained the tip and a more posterior portion of the bill of a swordfish, *Xiphias gladius*, separated from the mandible surface by a heavily eroded sequestrum about 110 mm long by 50 mm wide. This piece of bone lay in a shallow trough on the mandible's surface, approximately 160 mm long by 60 mm wide, which was pierced at its centre by a hole about 40 mm in diameter. The injury on the upper lip is thought to be the position of entry of the swordfish bill and the sequestrum was possibly formed from a thin piece of bone broken off on the impact of the bill with the mandible. The swordfish was estimated to be about 2 m in length by comparison with a specimen of similar size in the PEM collection.

The teeth of this whale were worn down to the level of the gums anteriorly but were less extensively worn posteriorly. The wear on the anterior eight teeth in each mandible was sufficient to expose the pulp cavity and had reduced the most anterior teeth to thin, hollow tubes. The four anterior teeth on the left side were sufficiently weakened by this wear to have collapsed inwards and remained as fragments in the alveoli.

Caldwell and Brown (1964) have described similar wear in an old female *O. orca*. From studies of several specimens they deduced that teeth of these whales wear as a result of vertical, lateral and palinal movements of the jaw which occur during feeding. They point out that such extreme wear might be expected in older animals as a normal consequence of feeding behaviour.

PEM 1520/40 is considered to have been maturing sexually and therefore was probably not very old in terms of the life span of male *O. orca*. This suggests that the tooth wear in this animal was abnormally rapid, possibly as a result of continual irritation set up by the mandibular abscess and its contents causing grinding of the teeth. The sequestrum and fragments of the swordfish bill showed evidence of wear on surfaces which were in contact with each other.

The presence of the swordfish bill in this whale is of interest as it appears to be the first such occurrence recorded for any odontocete species. Previously, swordfish and marlin bills have been recovered from large baleen whales, including blue, fin, sei and minke whales (Brown, 1960; Machida, 1970; Ohsumi, 1973; Peers and Karlsson, 1976). Brown (1960) suggested that these injuries resulted from accidental ramming by the fish whilst they were feeding on prey sheltering under or close to the whales, rather than from deliberate attacks on the whales.

In the present instance the longitudinal orientation of the swordfish bill fragments in the abscess suggested a frontal collision. However, the form and position of the entry hole suggest that the swordfish approached the whale from above and slightly on the right side, with subsequent rotation on impact, driving the bill along the whale's mandible. It is uncertain whether the presence of the bill resulted from a deliberate attack or from an accidental collision, perhaps while chasing the same prey animal.

### Distribution and migration

*O. orca* is cosmopolitan in distribution, occurring in coastal and oceanic waters from the polar ice pack to the equator. It is more numerous in the colder Arctic and Antarctic waters (Norman and Fraser, 1948). This species has been recorded along the southern African coastline from Saldanha Bay (33°S, 18°E) (Barnard, 1954) to Natal (fig. 32). A record of a stranded *O. orca* at Inhambane, Mozambique (23° 51′S, 35° 29′E) in April 1964 is particularly interesting in view of the lack of cetacean data from that region (photograph in ORI files, Durban).

The distribution by month of the records of *O. orca* on the SE coast (Table 52) suggests that this species may be found in this region throughout the year. The absence of records for November and December almost certainly reflects the lack of active whaling and limited observations at sea at this time.

Jonsgard and Lyshoel (1970) have shown a correlation between the distribution and seasonal abundance of *O. orca* and herring in the NE North Atlantic. There are insufficient observations on *O. orca* and its diet at present to suggest that similar prey-related movements occur in the SW Indian Ocean.

## Genus *PSEUDORCA* Reinhardt, 1862

*Overs. Danske Vidensk. Selsk. Forh.*, 151; type species *Pseudorca crassidens* (Owen), by original designation.

These are small whales up to 5,8 m in length with a small, globose, depressed head. The melon is well-developed and overhangs the tip of the upper jaw. There is no beak. The dorsal fin is small and falcate and the flippers are relatively small and pointed.

The rostrum of the massive skull is short and broad. The premaxillaries are expanded and

Table 52:

The monthly incidence of *Orcinus orca* from the SE coast of southern Africa.

| Source | January | February | March | April | May | June | July | August | September | October | November | December |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Strandings (Table 47) | 1 | — | — | — | — | 1 | — | — | 1 | 1 | — | — |
| Sightings (Table 48) | 2 | 4 | — | 1 | 1 | — | — | 3 | — | — | — | — |
| Commercial Catch 1971–75 (Best and Ross, 1977) | — | — | 0 | 4 | 10 | 3 | 9 | 2 | 8 | — | — | — |

abruptly truncated distally. The pterygoids are short. Each jaw carries seven to 11 teeth which are round in transverse section.

A single widespread species *P. crassidens* (Owen) is recognized.

### ***Pseudorca crassidens*** (Owen, 1846)
### False Killer Whale

*Phocaena crassidens* Owen, 1846: 516 (holotype, subfossil skull, apparently no longer available—Hershkovitz, 1966; type locality Lincolnshire Fens, near Stanford, England).

*Pseudorca crassidens* Reinhardt, 1862: 151; Gill, 1936: 541; Smithers, 1938: 403; Roberts, 1951: 226; Ellerman, Morrison-Scott and Hayman, 1953: 331; Barnard, 1954: 24; Best, 1971: 5.

#### RECORDS AND MATERIAL

Details of eight specimens stranded on the SE coast are given in Table 53 and the localities and numbers recorded in six sightings of this species are listed in Table 54. The distribution of these records is mapped in Fig. 33.

TABLE 53:

Records of specimens of *Pseudorca crassidens* from the SE coast of southern Africa.

| Catalogue Number | Sex | Total length (mm) | CBL (mm) | Date | Locality | Comments |
|---|---|---|---|---|---|---|
| — | — | — | — | April 1910 | Port Alfred | Skull registered in PEM catalogue, now missing. |
| PEM 1514/69 | — | *c.* 4500 | — | 1920–1930 | Kaiser's Beach | Rostrum, mandibles and teeth in PEM. |
| ELM 780 | — | — | 435+ | 01.05.61 | East London | Skull in PEM. |
| — | — | — | — | 13.11.65 | Kariega River Mouth | Photograph in PEM files. |
| PEM 1515/22 | — | — | 615 | pre 1970 | Klipdrift | Skull, three vertebrae in PEM. |
| SAM 36320 | ♂ | 3 580 | — | 08.02.71 | 34° 34′S, 31° 43′E | Whole skeleton in SAM. Harpooned from a school of 30 animals. |
| PEM 1520/63 | — | — | — | pre 1977 | Cape St. Francis | Part of mandible and five teeth in PEM. |
| PEM 1520/76 | — | 1 670 | 360 | July 1977 | Bushmans River Mouth | Skull in PEM. |

TABLE 54:

Sight records of *Pseudorca crassidens*, *Feresa attenuata* and *Globicephala* sp. off the SE coast of southern Africa. Data from IOS (1969, 1971, 1972, 1973) and Gambell *et al.* (1975).

| Species | Date | Number | Locality |
|---|---|---|---|
| *P. crassidens* | | | |
| | 08.02.71 | 30* | 30° 36′S, 31° 39′E |
| | 13.02.71 | 1 | 31° 59′S, 31° 21′E |
| | 02.02.73 | 6 | 29° 56′S, 32° 00′E |
| | 09.02.73 | 2 | 33° 58′S, 28° 07′E |
| | 10.02.73 | 50 | 34° 08′S, 27° 21′E |
| | 09.01.74 | 10 | 31° 37′S, 31° 05′E |
| *F. attenuata* | | | |
| | 16.08.69 | 11 | 31° 38′S, 30° 07′E |
| *Globicephala* sp. | | | |
| | 17.02.71 | 25 | 30° 58′S, 31° 27′E |
| | 01.02.72 | 10 | 30° 17′S, 31° 35′E |

* Specimen collected from this school (Table 53).

### SPECIFIC STATUS AND CHARACTERS

The monotypic status of this genus has been long established (Reinhardt, 1862; True, 1889) and the diagnostic features of the single species, *P. crassidens* are the same as those for the genus.

The possible existence of morphologically distinct populations has not been established owing to a lack of material from different localities and to a lack of knowledge of the degree of variation to be expected within a population. Measurements of adult specimens (CBL > 600 mm) from the Atlantic (four; van Bree, 1972; True, 1889), southern Africa (PEM 1503/22, PEM 1515/22; Table 55), Pakistan (one; Pilleri and Gihr, 1976a) and New Zealand (four; van Bree, 1972) show that the crania are very similar in almost all their proportions. However, the Atlantic and southern African specimens are proportionately slightly broader than those from

TABLE 55:

Skull measurements in mm of five *Pseudorca crassidens* from southern Africa. Measurement numbers are keyed to Table 6.

| Measurement Number | PEM 1520/76 | ELM 780 | PEM 1515/22 | PEM 1514/69 | PEM 1503/23 |
|---|---|---|---|---|---|
| 1 | 360 | 435+ | 615 | — | 653 |
| 2 | 159 | 192+ | 295 | — | 320 |
| 3 | 92 | 127 | 190 | — | 233 |
| 4 | 81 | 127 | 199 | — | 237 |
| 5 | 74 | (110) | 180 | — | 207 |
| 6 | 48 | — | 125 | — | 156 |
| 7 | 199 | 239 | 372 | — | 397 |
| 8 | 215 | — | 395 | — | 410 |
| 9 | 159 | 210 | 331 | — | 377 |
| 10 | 190 | 243 | 367 | — | 412 |
| 11 | 166 | 212 | 335 | — | 378 |
| 12 | 58 | 67 | 77 | — | 97 |
| 13 | 205 | 245 | 370 | — | 426 |
| 14 | 83 | 112 | 133 | — | 156 |
| 15 | 161 | 178 | 223 | — | 240 |
| 16 | 8 | 7+ | 8 | 9 | 8 |
| 17 | 8 | 7+ | 8 | 8 | 8 |
| 18 | 127 | — | 215 | 231 | 234 |
| 19 | 127 | — | 220 | 206 | 232 |
| 20 | 132 | — | 244 | 247 | 262 |
| 21 | 133 | — | 250 | 244 | 260 |
| 22 | 9 | 9 | — | 9 | 9 |
| 23 | 9 | 9 | — | 9 | 9 |
| 24 | 143 | 175 | — | 218 | 242 |
| 25 | 139 | 180 | — | 220 | 238 |
| 26 | 149 | 184 | — | 228 | 248 |
| 27 | 145 | 185 | — | 232 | 246 |
| 28 | 284 | 358 | — | 460 | 546 |
| 29 | 74 | 98 | — | 112 | 149 |
| 30 | 55 | 53 | — | 89 | 94 |
| 31 | 93 | 131 | 175 | — | 184 |
| 32 | 63 | 86 | 130 | — | 134 |
| 33 | 51 | — | 137 | — | 170 |
| 34 | (140) | 158 | 228 | — | 230 |
| 35 | 45 | — | — | — | — |
| 36 | 45 | — | — | — | — |

( ) denotes approximate measurement.

New Zealand and Pakistan. The range of variation in the former and latter samples respectively (expressed as percentages of CBL) are preorbital width (meas. 9): 53,0 – 57,7 and 48,2 – 52,3; postorbital width (meas. 10): 58,1 – 63,1 and 53,9 – 57,0; zygomatic width (meas. 13): 59,6 – 65,2 and 54,9 – 59,4. The significance of such differences between small samples is not clear as they may result from individual or inter-school variation. Thus the zygomatic width of a specimen from Tasmania (62,5 per cent CBL) falls within the range of variation of specimens from the Atlantic (Scott and Lord, 1919). Further evaluation will require large series of specimens such as might be provided by the mass strandings for which this species is well known.

### Description

A 3,58 m male *P. crassidens* (SAM 36320) is illustrated in Fig. 16.

The body is slender in build, slightly compressed laterally anterior to the dorsal fin and becomes progressively more compressed caudally. The head is comparatively small in relation to the body. The melon is globose, tapered and rounded anteriorly and projects slightly beyond the tip of the mandibles. There is no beak. The flippers are broad anteriorly and taper to a rounded apex; their anterior margin is markedly convex proximally and slightly concave distally. The dorsal fin, erect and falcate, is in height about 8% of body length. It is placed at approximately mid-length of the body, being more anteriorly set in males than in females and in older animals of both sexes (Tomilin, 1957). The flukes are broad and tapered laterally.

External measurements of a calf (PEM 1520/76) from this region are provided in Table 49.

*P. crassidens* is entirely black in colour, though a greyish mid-ventral streak may be present. In SAM 36320 a grey patch between the flippers extended posteriorly as a narrow streak in the mid-line to join a further ill-defined greyish area surrounding the anus and genital slit.

The skull is massive with a short, broad rostrum which increases in width with age (Tomilin, 1957). The premaxillaries are characteristically narrow proximally and expanded distally with subparallel lateral margins over most of the length of the rostrum. They are truncate anteriorly. The mandibles are robust and thickened proximally, unlike those of *Globicephala* and small delphinids in which the bone in this region is normally thin.

The number of teeth in each jaw varies from seven to 11. The tooth counts in 34 of 38 specimens from the western Cape coast were eight to nine in each upper jaw and nine to 10 in each mandible (Smithers, 1938).

Tooth counts and skull measurements for five specimens from southern Africa are listed in Table 55.

The vertebral formula of PEM 1520/76 was C7 T10 L9 Cd21 = 47. The total number of vertebrae in this calf is less than the normal number recorded for this species (50 or 51) (Tomilin, 1957; True, 1889). It is possible that one or two terminal caudal vertebrae were insufficiently ossified and were consequently missed during counting.

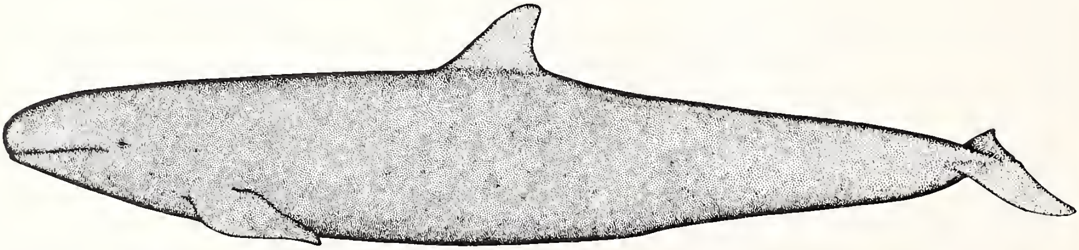


Fig. 16. Subadult male *Pseudorca crassidens*, 3,58 m in length, from Natal waters (SAM 36320).

### BIOLOGY

*Age determination:* Polished half teeth from two juveniles and thin longitudinal sections from two adults were examined in reflected and transmitted light respectively.

The largest available tooth from the calf PEM 1520/76 was a hollow cone 26 mm in height and approximately 16 mm in diameter at its base and consisted of dentine covered by a cap of enamel 18 mm in height. The dentine was formed almost entirely of uniform, opaque prenatal material, about 1,1 mm in thickness near the apex of the pulp cavity. A clear neonatal line was present. A very thin layer of postnatal dentine approximately 40 $\mu$ thick lined the pulp cavity, indicating that this animal had been born recently.

The prenatal dentine of ELM 780 was approximately 1 mm thick near the apex of the pulp cavity. The neonatal line was well defined, marking the outer limit of a uniform layer of postnatal dentine 0,7 mm in thickness, representing a layer count of less than one. The pulp cavities of PEM 1514/69 and PEM 1520/63 were almost entirely occluded by laminated dentine except at the tooth bases where translucent secondary dentine was present. Approximately 18 layers were counted in PEM 1520/63 and 13 or 14 layers in PEM 1514/69. These represent minimum counts since dentine deposition had ceased for an unknown period before death.

*Growth and development:* The available data suggest a length at birth of about 1,6 m. The thin postnatal dentine of the 1,67 m calf PEM 1520/76 indicates that it had been born recently. Smithers (1938) reported on a suckling calf 1,57 m in length. Foetuses of 1,6 m and 1,63 m in length have been recorded (Tomilin, 1957; Scott and Green, 1975), though one foetus 1,83 m in length was noted by Norman and Fraser (1948).

Male *P. crassidens* may attain a length of 5,8 m (Reinhardt, 1862; Smithers, 1938), though most males measured to date have been less than 5,2 m in length. Females are on average 0,5 m to 1 m shorter than the males (Peacock *et al.*, 1936; Smithers, 1938).

The intact carcase of the 3,58 m male SAM 36320 weighed 372 kg.

*Reproduction:* No reproductive material from this species was collected during this study.

Sexual maturity is attained at lengths of 3,6 m or more in females (Tomilin, 1957; Scott and Green, 1975). The lengths of foetuses recorded in mass strandings indicate a calving season extending over several months (Norman and Fraser, 1948; Scott and Green, 1975).

The sex ratio is approximately equal in stranded schools (Norman and Fraser, 1948).

*Food and feeding:* The stomach of SAM 36320 contained the lower beaks of 11 cephalopods. These have been identified as those of the genera *Todarodes* (6 specimens), *Oregoniateuthis* (1 specimen), *Phasmatopsis* (1 specimen), *?Galiteuthis* (1 specimen), an ommastrephid and an unidentified fragment. Tomilin (1957) suggested that *P. crassidens* feeds predominantly on cephalopods, though salmonid and gadid fish have been recorded in stomachs. However, observations of feeding in the Pacific show that this species frequently preys on large pelagic fishes such as coryphaenids and scombrids (Brown *et al.*, 1966). Fraser (1936) suggested that the mass strandings of *P. crassidens* in Scotland were associated with inshore migrations of large numbers of cephalopods.

The five available teeth of PEM 1520/63 were deeply worn on their posterior surfaces, at an oblique angle, suggesting that the wear resulted from contact with the apices and anterior surface of the upper teeth. The most posterior tooth of this specimen also showed slight wear on the lingual and anterior surfaces at gum level. The teeth of PEM 1514/89 were worn slightly on the anterior and posterior surfaces of the crowns of the teeth and several of them were worn slightly on their lingual surfaces at gum level. At least three teeth showed some degree of lingual undercutting. Such wear implies that *P. crassidens* is capable of making small lateral and palinal jaw movements in addition to vertical movements and in this respect resembles *O. orca* (Caldwell and Brown, 1964). However, the small amount of wear that has occurred compared to the apparent old age of both specimens would suggest that such movements are relatively infrequent. Caldwell and Brown (1964) related this form of tooth wear in *O. orca* to

Table 56:

Reproductive data for two *Orcinus orca* and four *Globicephala macrorhynchus* males from the SE coast of southern Africa.

| Catalogue Number | Total length (mm) | No. of dentine layers | Size of testis (mm) | | Mass of testis (g) | | | Diameter of tubules (μ) | Comments |
|---|---|---|---|---|---|---|---|---|---|
| | | | Left | Right | Left | Right | Total | | |
| *O. orca* | | | | | | | | | |
| PEM 1518/74 | 2 270 | <1 | 58×19 | 53×20 | 11 | 10 | 21 | c.25 | Immature. Tissues broken badly. |
| PEM 1520/40 | 6 050 | 16+ | — | 490×160 | — | 7 200 | — | 170 | Maturing. Very few sperm in tubules. Sperm in epididymis. |
| *G. macrorhynchus* | | | | | | | | | |
| PEM 1515/39 | 4 370 | 12 | *265× – | 265× – | 725 | 770 | 1 495 | (205) | Some sperm present in tubules. Tissue macerated. |
| PEM 1515/40 | 5 080 | — | *510× – | 455× – | 2 950 | 3 540 | 6 490 | (210) | Few sperm present in tubules. Tissue macerated. |
| PEM 1515/38 | 5 130 | 14 or 15 | *480× – | 455× – | 2 720 | 2 540 | 5 260 | — | Few sperm present in tubules. Tissue very macerated. |
| PEM 1516/89 | 5 200 | *c*.13 | 585× – | 535× – | 2 720 | 2 860 | 5 580 | — | — |

* not sided

( ) denotes approximate measurement.

the violent feeding actions associated with breaking up large prey. The evidence from *P. crassidens* indicates that this species rarely tackles prey as large as those taken by *O. orca*.

*School size:* The numbers of animals in schools that have stranded *en masse* is normally very large, ranging from 50–835 animals and averaging about 180 animals for 14 such strandings (Barnard, 1954; Tomilin, 1957; Caldwell *et al.*, 1970; Aitken, 1971; Scott and Green, 1975).

The size of schools observed at sea, however, is usually much smaller. These schools normally contain fewer than 50 animals and often fewer than 20 (Table 54; Fiscus and Niggol, 1965; Pilleri and Knuckey, 1969; Morzer Bruyns, 1969).

This difference in school size is of interest since it suggests that schools involved in mass strandings are composed of several smaller groups that have joined for a purpose, possibly during exploitation of locally abundant, migrating populations of cephalopods.

### Distribution and migration

*P. crassidens* is an oceanic species found in tropical and temperate waters of all oceans, occurring as far north as the Davis Strait in the Atlantic, and the Kuril Islands in the Pacific, while strandings have been recorded on the Patagonian coast and in New Zealand (Tomilin, 1957).

In southern African waters mass strandings have been recorded on the west coast on three occasions (Barnard, 1954). However, records for the SE coast all involve single animals. Sight records off this coast (Table 54) were all made well off-shore in the Agulhas current.

The limited data from strandings and sightings in this region do not indicate seasonality in occurrence of this species. These records span at least 65 years, and, in view of the conspicuousness of *P. crassidens* at sea and its readiness to approach and bowride ships, the apparent rarity of sight records of strandings could indicate that *P. crassidens* occurs sporadically in this region.

## Genus *FERESA* Gray, 1870

*Proc. zool. Soc. London*, 1870: 77; type species *Orca intermedia* Gray by monotypy.

These are small whales up to 2,6 m in length. The head is tapered and rounded anteriorly with no beak. The body is slender posteriorly. The dorsal fin is erect, high and falcate. The rostrum has a length half of the condylobasal length and is broad. The premaxillae are flattened dorsally and expanded proximally and distally to more than two-thirds of rostral width. There are eight to 13 teeth occupying two-thirds of the length of each jaw.

A single species *F. attenuata* is currently recognized.

## ***Feresa attenuata*** Gray, 1874

## Pygmy Killer Whale

*Delphinus intermedius* Gray, 1827: 376 (holotype, skull, BM 1672a–74.11.25.1.; type locality, unknown.
*Feresa attenuata* Gray, 1874: 238; Bass, 1969: 36; Best, 1970: 1; Best, 1971: 4.

### Records and material

Four strandings (Table 57) and one sighting (Table 54) of *F. attenuata* are known from the SE coast of southern Africa. The distribution to these records is shown in Fig. 34.

### Specific status and characters

Prior to 1952 the genus was known only from two skulls each assigned to a different species. Studies of a number of specimens obtained subsequently have shown, however, that there is a single species with a wide distribution (Fraser, 1960; Nishiwaki *et al.*, 1965a).

Skeletal material from five animals stranded at Luderitz, South West Africa, was de-

TABLE 57:

Records of *Feresa attenuata* and *Globicephala melaena* stranded on the SE coast of southern Africa.

| Catalogue Number | Sex | Total length (mm) | CBL (mm) | Date | Locality | Comments |
|---|---|---|---|---|---|---|
| *F. attenuata* | | | | | | |
| PEM 1514/09 | — | — | 385 | 06.03.57 | Schoenmakerskop | Skull, photograph in PEM. |
| SAM 35601 | ♀ | 2 415 | — | 16.05.68 | Richards Bay | Rostrum, mandibles and teeth in SAM (Bass, 1969; Best, 1970). |
| PEM 1515/41 | ♂ | 2 590 | 387 | 09.04.70 | 2 km E. of Woody Cape | Skull in PEM. Stranded with PEM 1515/42. |
| PEM 1515/42 | ♂ | 2 420 | 405 | 09.04.70 | 2 km E. of Woody Cape | Whole skeleton in PEM. |
| *G. melaena* | | | | | | |
| PEM 1513/108 | — | — | 621 | 1968 | Gamtoos River Mouth | Skull in PEM. |
| PEM 1518/22 | ♀ | 4 500 | — | 10.02.72 | 4 km E. Sundays River Mouth | Teeth in PEM. |
| ELM 27 | — | — | 647 | — | Bonza Bay | Skull in PEM. |

scribed by Best (1970), who found that his sample differed from material from Japan in several skull dimensions including the least width of the premaxillae proximally, the extension of the vomer posteriorly, the length of the mandibular symphysis and the depth of the temporal fossae. In the new specimens examined for this study three of these measurements (Table 58, nos. 30, 37 and 38) have some values which are intermediate between those of the Luderitz and the Japanese specimens and therefore supporting Best's (1970) opinion that the differences he found were local variations and not of specific importance. The depths of the temporal fossae (Table 58, meas. 32) in the present material were very similar to those in the Luderitz specimens and less than those given for the Japanese material.

## DESCRIPTION

A female 2,24 m in length (SAM 35870) is illustrated in Fig. 17 (after Best, 1970). The grey flank patch, which was no longer visible in this specimen, has been added (after Nishiwaki *et al.*, 1965a).

The anterior half of the body is moderately robust and slightly compressed laterally. Post-

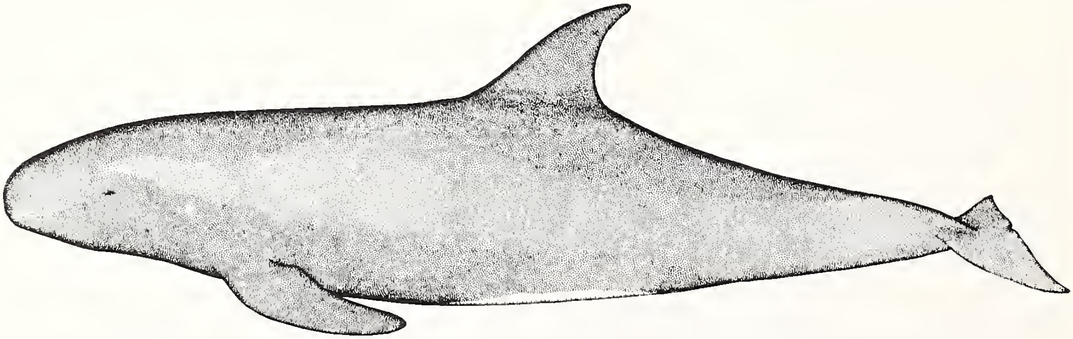


Fig. 17. Adult female *Feresa attenuata*, 2,24 m in length, from the south western Cape (SAM 35870).

TABLE 58:

Skull measurements in mm of three *Feresa attenuata* from the SE coast of southern Africa. Measurement numbers are keyed to Table 6.

| Measurement Number | PEM 1514/09 | PEM 1515/41 | PEM 1515/42 |
|---|---|---|---|
| 1 | 385 | 387 | 405 |
| 2 | 185 | 187 | 195 |
| 3 | 114 | 127 | 118 |
| 4 | 96 | 106 | 103 |
| 5 | 88 | 97 | 95 |
| 6 | 55 | 59 | 63 |
| 7 | 243 | 246 | 252 |
| 8 | 235 | 236 | 253 |
| 9 | 208 | 232 | 227 |
| 10 | 234 | 248 | 248 |
| 11 | 210 | 231 | 228 |
| 12 | 51 | 56 | 53 |
| 13 | 232 | 255 | 243 |
| 14 | 99 | 107 | 98 |
| 15 | 157 | 161 | 160 |
| 16 | 9 | 9 | 10 |
| 17 | 10 | 9 | 10 |
| 18 | 104 | 112 | 126 |
| 19 | 115 | 112 | 122 |
| 20 | 111 | 117 | 135 |
| 21 | 120 | 118 | 135 |
| 22 | 12 | 12 | 13 |
| 23 | 12 | 12 | 12 |
| 24 | 136 | 142 | 144 |
| 25 | 133 | 140 | 137 |
| 26 | 138 | 146 | 145 |
| 27 | 136 | 145 | 138 |
| 28 | 297 | 307 | 309 |
| 29 | 71 | 86 | 86 |
| 30 | 31 | 38 | 38 |
| 31 | 65 | 76 | 72 |
| 32 (L) | 59 | 64 | 65 |
| 32 (R) | 64 | 70 | 71 |
| 33 | 70 | 78 | 78 |
| 34 | 141 | 150 | 145 |
| 35 | — | 39 | 42 |
| 36 | — | 40 | 43 |
| 37* | 56 | 64 | 63 |
| 38** | 285 | 287 | 298 |

* Least width of premaxillae proximally.

** Tip of rostrum to posterior extension of vomer in the midline.

erior to the dorsal fin, however, the body is notable slender. A narrow groove is present mid-ventrally between the lower thoracic region and the genital aperture. The head tapers to a broadly rounded apex in dorsal view. The melon projects beyond the tips of the mandibles and appears well-formed but is not bulbous in lateral view.

The flippers are moderately long (20–23% of total length), broadened proximally and taper to a rounded apex. The leading edge is convex and the central portion of the trailing edge is concave. The dorsal fin is high, erect and falcate, with a convex leading edge. It is set at approximately mid-length of the body. The flukes are broad antero-posteriorly and taper laterally to a point. The trailing edges of the appendages of most specimens are indented irregularly.

External measurements of PEM 1515/41 and PEM 1515/42 are given in Table 49.

This species is bluish-black in colour on the dorsal surface and most of the lateral and ventral surfaces. Around the genital and anal apertures there is an irregular patch of white which extends anteriorly in the midline and there are narrow streaks of white on the upper and lower lips. An ill-defined area of greyish pigment is present between the flippers. In fresh specimens and live animals a grey area of pigment is readily apparent on the flank, extending from the caudal peduncle to the eye and onto the ventral surface posterior to the anal aperture (Nishiwaki *et al.,* 1965a; Best, 1970). Specimens examined in the present study were too abraded or decomposed for colour patterns to be noted.

The skull is characterized by the broad rostrum which constitutes almost half the condylobasal length. The premaxillae are greatly expanded proximally, narrowing to their least width in the proximal half of the rostrum and expanding laterally in the distal half to more than two-thirds of rostral width before tapering in an even curve to the tip of the rostrum. Comparison of the skull measurements of the present material (Table 58) with those of other specimens (Best, 1970) indicated the close similarity of all material described to date.

The teeth occupy the anterior two-thirds of the rostrum and slightly under half the length of the mandible. They vary in number from eight to 12 in each upper jaw and 10 to 13 in each lower jaw, and the most usual numbers are nine to 10 and 12 to 13 respectively.

The vertebral formula of PEM 1515/42 is C7 T13 L16 Cd30(+1) = 66(+1). The anterior six ribs are bicipital. The ranges of vertebral components tabled by Best (1970) are C7 T12–13 L15–17 Cd32–34 = 67–70 for five specimens from Luderitz and 15 specimens from Japan.

## BIOLOGY

*Age determination:* Teeth from PEM 1515/41 and PEM 1515/42 were sectioned and examined in transmitted light.

Growth layers were clearly visible in the outer part of the dentine but were less clear towards the pulp cavity. In PEM 1515/41 the pulp cavity was all but obliterated by a thin column of translucent secondary dentine. Approximately 14 layers were present prior to the secondary dentine. The structure of PEM 1515/42 was similar but the secondary dentine partially filled a broader cavity which extended for half the length of the tooth. There were also approximately 14 layers in the dentine of this tooth.

PEM 1515/41 was physically mature. Though the skeleton of PEM 1515/42 was not collected, it is probable that this specimen was older than PEM 1515/41 since the mandibles were fused together over three-quarters of the length of the symphysis. Similar fusion of the symphysis is illustrated in two specimens by Best (1970) and one specimen by Nishiwaki *et al.* (1965a). These three animals were physically mature.

*Growth and development:* The physically mature male PEM 1515/41, 2,59 m in length, is the longest specimen recorded. Four male and six female specimens known to be physically mature were 2,15 m–2,40 m and 2,21 m–2,39 m in length respectively and the longest physically immature specimen was 2,21 m (Nishiwaki *et al.*, 1965a; Best, 1970). There appears to be no difference between the lengths of males and females (Best, 1970).

*Reproduction:* No reproductive material was obtained during this study.

Very little is known concerning reproduction in *F. attenuata*. Two pregnant females from Japan were 2,21 m and 2,27 m in length (Nishiwaki *et al.*, 1965a). There are no data on length of gestation or on calving season. Sperm was present in the testes of a 2,16 m male from Hawaii; these testes weighed 320 g and 337 g (Pryor *et al.*, 1965).

*Food and feeding:* A note in the PEM accession catalogue stating that the stomach of PEM 1514/09 contained cephalopod beaks appears to be the only information on food taken in the wild.

In captivity one animal accepted live sardines but rejected squid, saury and mackerel-pike (Nishiwaki *et al.*, 1965a).

### DISTRIBUTION AND MIGRATION

The distribution of 12 locality records has been mapped and discussed by Caldwell and Caldwell (1971b) who pointed out that the majority of records are from within the tropics and concluded that this species normally inhabits tropical, sub-tropical and possibly warmer waters of warm-temperate regions. Subsequent records from the Gulf of Mexico (James *et al.*, 1970), New South Wales (Bryden, 1976) and the present study area support this conclusion.

On this basis the stranding of five animals at Luderitz in January 1968 appears anomalous as the surface temperature in that month is approximately 12° C near the coast. However, these animals may have travelled from offshore waters which reach 18° C within 200 km of the coast (Stander, 1964). Similarly the specimen stranded at Sea Point, Cape Town on 2 January, 1970 may have originated off the Cape Peninsula in the warm water which may reach 18° C or more within 50 km of the shore during the latter part of December.

The single sight record and three strandings on the SE coast were recorded in March, April, May and August. These few data suggest that *F. attenuata* may be expected in this region in any month of the year, or perhaps is resident in the area throughout the year.

## Genus *GLOBICEPHALA* Lesson, 1828

*Complement des oeuvres de Buffon ou Histoire naturelle des animaux rares de couverts . . . depuis la mort de Buffon,* 1: 276, 441; type species, *Delphinus globiceps* Cuvier, 1812, by original designation.

These are small to medium sized whales attaining lengths of up to 7,6 m.

The melon is globular, projecting anteriorly beyond the short stubby beak, especially in adult males. The flipper is narrow and elongate, up to 27% of body length. The dorsal fin is low, elongated basally and set about one-third body length from the head.

The rostrum is about half the length of the skull and very broad. The premaxillae expand laterally in the distal half of the rostrum and are characteristically rugose dorsally at about mid-length of the rostrum in adult specimens. The mandibular symphysis is short (9–12% CBL). There are six to 12 teeth in the anterior half of each jaw though some may be absent in old animals.

Two species, *G. melaena* (Traill) and *G. macrorhynchus* Gray, are currently recognized and are distinguished from each other by the length of the flipper, the number of teeth and the width of the premaxillae on the rostrum (Fraser, 1950b; van Bree, 1971d).

### *Globicephala melaena* (Traill, 1809)
### Long-finned Pilot Whale

*Delphinus melas* Traill, 1809: 81 (lectotype, skull, BM 363a–44.12.3.2.; type locality, Pomona, Orkney Islands).
*Phocaena edwardii* A. Smith, 1834: 239 (type locality Slangkop, Cape Peninsula); van Bree, Best and Ross, 1978: 1.
*Phocaena edwardsii* True, 1889: 135.
*Globiocephalus edwardsii* Gray, 1866: 320
*Globicephala melaena* Thomas, 1898: 99; Roberts, 1951: 225 (in part); Barnard, 1954: 24; Best, 1971: 5; van Bree, Best and Ross, 1978: 1.
*Globicephala leucosagmophora* Rayner, 1939: 543 (type locality 65 km SSW of Cape of Good Hope)
*Globicephala edwardi* Ellerman, Morrison-Scott and Hayman, 1953: 333.

### RECORDS AND MATERIAL

Details of three records of *G. melaena* on the SE coast of southern Africa are given in Table 57.

### SPECIFIC STATUS AND CHARACTERS

*G. melaena* is a well established species characterized externally by relatively long flippers (18–27% of the body length), a white blaze on the ventral surface between the flippers and narrow premaxillae on the rostrum of the skull leaving at least 10 mm of each maxilla exposed along its lateral margin. There are nine to 12 teeth in each tooth row (Fraser, 1950b; van Bree, 1971d).

This species has an antitropical distribution in the North Atlantic, and southern hemisphere and is known to have occurred in the North Pacific (Kasuya, 1975).

No osteological differences have been demonstrated between specimens from the northern and southern hemipheres (True, 1889; Rayner, 1939; Barnard, 1954; Kasuya, 1975; present study). Rayner (1939), however, proposed the name *G. leucosagmophora* for southern hemisphere specimens based on the presence of a whitish-grey saddle-shaped area on the dorsal surface posterior to the dorsal fin and of a white postocular streak. These features are absent in most North Atlantic specimens, though a proportion of Newfoundland specimens have a greyish dorsal saddle (Sergeant and Fisher, 1957) and a dark grey postocular streak (Sergeant, 1962a). Moreover Davies (1960) noted that these markings may be absent in some southern hemisphere animals and proposed that the two forms should not be given more than subspecific status. The name *G. melaena edwardii* would be available for the southern hemisphere form.

### DESCRIPTION

The illustration of *G. melaena* (fig. 18) is based on measurements and body form of a 4,5 m female, PEM 1518/22. As the colour pattern on this specimen had been obliterated by decomposition it has been based on drawings of a Tasmanian specimen illustrated by Scott (1942), and on a photograph of an animal at sea (Aguayo, 1975).

The body of *G. melaena* is robust, slightly compressed laterally, anteriorly and increasingly so towards the flukes.

The caudal peduncle is deep and strongly keeled dorsally. The melon is bulbous and somewhat truncated in dorsal view. In profile the melon projects beyond the tip of the upper jaw but immediately dorsal to the mouth is concave forming a short, distinct beak. The gape is oblique to the long axis of the body. The flippers are long and narrow and taper to a pointed apex. The leading edge is sinuous, being convex proximally and slightly concave distally. The dorsal fin height is about one-third to one-half of its length. The leading edge is convex, par-

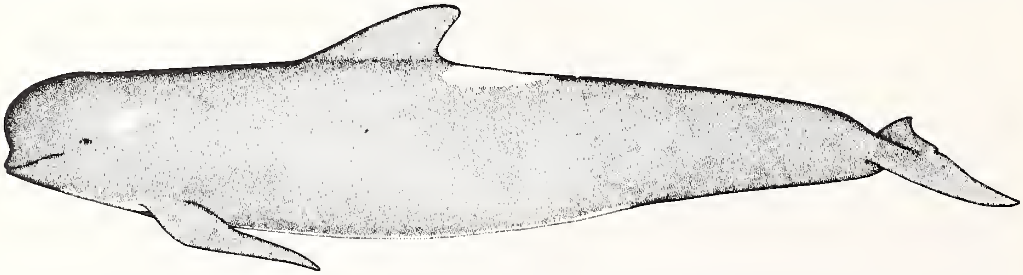


Fig. 18. Female *Globicephala melaena*, 4,50 m in length, from the eastern Cape (PEM 1518/22). (see note in text).

ticularly in adult males in which it becomes thickened and rounded in profile (Sergeant, 1962a). The trailing edge is deeply concave.

External measurements of PEM 1518/22 are compared to those of *G. macrorhynchus* in Table 59.

*G. melaena* is almost entirely black in colour, with a white ventral blaze which extends from the anterior part of the throat to the base of each flipper, and posteriorly as a narrow midventral streak as far as the umbilicus where it broadens between the umbilicus and anal aperture (Sergeant, 1962b; Scott, 1942). The postocular spot and the dorsal saddle-shaped areas

TABLE 59:

External measurements of one *Globicephala melaena* and ten *G. macrorhynchus* from the SE coast of southern Africa. Total length (measurement 1) in mm; other measurements are expressed as percentages of total length. Measurement numbers are keyed to Table 2.

| Measurement Number | *G. melaena* | *G. macrorhynchus* | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | PEM 1518/22 | PEM 1515/30 | PEM 1515/36 | PEM 1515/37 | PEM 1515/38 | PEM 1515/39 | PEM 1515/40 | PEM 1516/89 | PEM 1520/12 |
| 1 | (4500) | 3770 | 3960 | 4050 | 5130 | 4370 | 5080 | 5205 | 5895 |
| 2 | 7,3 | 10,4 | 10,6 | 9,7 | 9,9 | 9,6 | 8,3 | 8,8 | 9,1 |
| 3 | — | — | — | — | — | — | — | — | — |
| 4 | 6,4 | 9,1 | 11,0 | 8,5 | — | 7,8 | 7,5 | 8,3 | 7,3 |
| 5 | — | — | — | — | — | — | — | 11,7 | — |
| 6 | — | — | — | — | — | — | — | 3,2 | — |
| 7 | 2,7 | 2,4 | 1,9 | 2,2 | 2,4 | 2,3 | 1,8 | 2,2 | 2,4 |
| 8 | 9,8 | 8,8 | 9,8 | 8,2 | 7,9 | 9,9 | 7,8 | 9,3 | 8,2 |
| 9 | 10,4 | 10,8 | — | 10,0 | 9,4 | 9,3 | 8,0 | 9,3 | 8,2 |
| 10 | 13,8 | 18,2 | 15,9 | 16,3 | 14,4 | 15,6 | 14,0 | 16,6 | 18,1 |
| 11 | 31,8 | — | — | — | — | — | — | — | — |
| 12 | 48,7 | 47,8 | 51,5 | 47,6 | 44,6 | — | 45,0 | 43,9 | 43,1 |
| 13 | — | 44,4 | 48,5 | 42,6 | 43,1 | — | 40,5 | 41,5 | — |
| 14 | (64,4) | 62,6 | 78,8 | 62,1 | 57,9 | — | 55,5 | 53,7 | — |
| 15 | (66,7) | 66,0 | 75,8 | 66,5 | 66,8 | — | 65,5 | 62,4 | — |
| 16 | — | −3,4 | −2,3 | −1,9 | −1,5 | −2,6 | −1,5 | −2,4 | −1,7 |
| 18 a | — | 1,4 | 0,9 | 1,1 | 1,0 | 0,9 | 0,9 | 1,2 | — |
| b | — | 0,7 | 0,7 | 0,5 | 0,6 | 0,6 | 0,5 | 0,5 | — |
| c | — | 0,8 | 0,9 | 0,9 | 1,0 | 1,0 | 0,6 | 0,7 | — |
| 20 | — | 56,6 | — | 52,7 | 54,5 | 54,7 | 54,0 | 58,5 | — |
| 21 | — | 69,4 | — | 58,9 | 56,4 | 58,1 | 58,0 | — | — |
| 22 | — | 37,0 | 33,3 | 35,1 | 39,6 | 37,2 | 42,0 | — | — |
| 23 | — | 0,8 | — | 0,8 | 0,6 | 0,7 | 0,8 | — | — |
| 24 a | — | 2,0 | 3,0 | — | — | — | — | — | — |
| b | — | — | 4,2 | 2,4 | — | — | — | — | — |
| 25 a | — | 6,3 | 9,8 | 8,8 | — | 7,6 | 5,5 | 6,8 | — |
| b | — | 0,4 | 1,7 | 0,3 | — | — | — | — | 2,5 |
| c | (8,8) | — | — | — | — | — | — | — | — |
| 26 | — | 2,0 | — | 1,7 | 2,0 | 1,9 | 1,8 | 1,9 | 2,2 |
| 27 | 20,2 | 14,8 | 17,8 | 16,1 | 16,8 | 16,9 | 15,0 | — | 16,4 |
| 28 | 15,6 | 12,1 | 14,4 | 12,1 | 12,4 | 12,2 | 12,0 | — | 12,9 |
| 29 | 4,4 | 3,4 | 4,9 | 4,7 | 4,5 | 4,7 | 4,8 | — | 4,5 |
| 30 | (6,2) | 7,4 | 7,2 | 7,2 | 7,9 | 8,1 | 8,5 | 9,8 | 7,8 |
| 31 | (14,4) | 19,5 | (11,4) | 21,3 | 18,3 | 17,4 | 22,0 | 21,5 | 19,8 |
| 32 | 20,9 | 23,6 | 28,8 | 27,6 | 24,3 | 24,4 | 26,5 | (25,4) | 27,6 |
| 33 | 6,7 | 6,1 | 6,8 | 7,2 | 6,7 | 6,3 | 6,0 | 7,8 | 6,0 |
| 34 | (1,1) | 1,5 | 1,5 | 1,9 | 0,9 | 1,5 | 1,3 | — | 1,2 |

( ) denotes approximate measurement.

are white and pale grey respectively in most southern hemisphere specimens (Rayner, 1939; Brownell, 1974; Aguayo, 1975). Scott (1942) described these areas as being 'elephant' in colour but as he examined his specimens at least two days after stranding some darkening may have occurred.

None of the SE coast specimens was fresh enough for its colour to be determined.

Cranial measurements of two *G. melaena* are compared with those of *G. macrorhynchus* in Table 60. There appear to be no differences in the proportions of the two *G. melaena* skulls from this region and those of specimens from Japan, Chile and the North Atlantic given by Kasuya (1975).

The vertebral formula is C7 T11 L13(−14) Cd27(−29) = 58–60 (True, 1889).

## Biology

*Age determination:* Teeth from two specimens were sectioned and viewed in transmitted light while immersed in alcohol as described by Sergeant (1962b). Approximately 13 dentine growth layers were visible in the tooth of PEM 1513/108 before secondary dentine was formed in the pulp cavity. There were about 18 dentine growth layers in the tooth of PEM 1518/22 before the pulp cavity was filled. Sergeant (1962b) estimated by analogy with the deposition rate found in *Tursiops truncatus* (Sergeant, 1959), that one growth layer was deposited per year.

*Growth and development:* The 4,5 m female PEM 1518/22 provided the only information on length attained by *G. melaena* in this region. The length of this specimen corresponds closely to the mean length of females in the western North Atlantic with 14 or more dentine layers in their teeth (Sergeant, 1962b).

*Reproduction:* No data were collected in this study. A detailed study of reproduction in this species has been made for western North Atlantic specimens by Sergeant (1962b).

*Food and feeding:* Off Newfoundland *G. melaena* feeds almost exclusively on the ommastrephid squid *Illex illecebrosus* though cod, *Gadus morhua,* are taken on occasion (Sergeant, 1962b). Inshore movements of *G. melaena* are directly related to similar movements of this squid (Mercer, 1975). Off the Faroe Islands the main diet consists of the ommastrephids, *Todarodes sagittatus, Ommastrephes* sp. and shoaling fishes (Tomilin, 1957).

*School size:* The mean school size of 92 herds of *G. melaena* taken during commercial catching drives off Newfoundland was 85 animals. However, the average school size observed in the Labrador Sea during the same period was 20 animals which suggests that several groups may combine into larger schools before approaching the shore (Sergeant, 1962b). Similarly, the average school size of 83 groups seen by observers on two weather ships in the North Atlantic over a nine year period was about 33 (Brown, 1975) whereas the average number of animals in eight strandings on the British coast was 60 (range 2–148) (Harmer, 1927; Fraser, 1946, 1953, 1974).

The few data from the southern hemisphere do not show such clear differences between stranded schools and sightings. Scott (1942) reported on a stranding of 200–300 individuals in Tasmania. The average school size of 14 mass strandings in New Zealand was 61 (range 2–140), a variety of observers recorded about 70 animals per school in sightings and five sightings made by Gaskin (1968a) in the southern ocean averaged 76 animals per school (range 10–200). School size of sightings off the coasts of Chile and Ecuador ranged between 5 and 100 animals, but most schools contained 10–20 individuals (Aguayo, 1975).

## Distribution and migration

*G. melaena* occurs in the Mediterranean Sea and northern North Atlantic Ocean as far north as latitude 68° N (Tomilin, 1957). Evidence of its previous existence in the North Pacific has been given by Kasuya (1975). In the southern hemisphere this species has a circumpolar distribution from as far south as 70° S (Brownell, 1974) to warm temperate waters. On the

TABLE 60:

Skull measurements of two *Globicephala melaena* and ten *G. macrorhynchus* from the SE coast of southern Africa. Condylobasal lengths and tympanic bullae lengths are in mm; other measurements are expressed as percentages of CBL. Measurement numbers are keyed to Table 6.

| Measurement Numbers | *G. melaena* | | *G. macrorhynchus* | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PEM 1513/108 | ELM 27 | PEM 1515/36 | PEM 1516/87 | PEM 1496/69 | PEM 1515/37 | PEM 1515/30 | PEM 1516/88 | PEM 1515/39 | ELM — | PEM 1515/38 | PEM 1496/68 |
| 1 | 621 | 647 | 582 | 590 | 597 | 602 | 603 | 603 | 656 | 688* | 712 | 744 |
| 2 | 51,2 | 49,5 | 49,3 | 51,5 | 47,9 | 50,7 | 50,9 | 51,7 | 49,1 | 48,5 | 50,6 | 50,9 |
| 3 | 37,8 | 41,3 | 40,9 | 41,2 | 41,4 | 41,4 | 41,1 | 39,8 | 43,4 | 43,9 | 43,0 | 42,7 |
| 4 | 35,4 | 37,1 | 38,5 | 39,5 | 41,7 | 40,9 | 40,0 | 37,8 | 43,1 | 43,2 | 42,3 | 43,1 |
| 5 | 28,8 | 33,2 | 32,6 | 33,7 | 33,0 | 37,2 | 34,3 | 32,0 | 38,4 | 38,1 | 36,2 | 39,2 |
| 6 | 25,0 | 28,4 | 30,6 | 33,6 | 31,0 | 37,2 | 34,0 | 30,3 | 36,4 | 37,8 | 35,1 | 38,3 |
| 7 | 68,3 | 67,9 | 67,5 | 67,5 | 65,8 | 67,8 | 67,8 | 69,2 | 70,9 | 68,3 | 70,8 | 70,3 |
| 8 | — | — | 60,7 | 63,6 | 61,8 | 62,0 | 62,0 | 61,9 | 64,2 | 61,8 | 64,3 | 61,3 |
| 9 | 60,9 | 63,4 | 65,6 | 67,3 | 67,8 | 67,8 | 66,8 | 65,7 | 72,9 | 71,5 | 73,7 | 69,0 |
| 10 | 67,6 | 71,7 | 72,2 | 75,3 | 74,0 | 75,2 | 72,3 | 71,0 | 78,2 | 78,1 | 78,4 | 74,7 |
| 11 | 62,8 | 66,9 | 66,7 | 68,1 | 67,3 | 67,8 | 66,8 | 65,0 | 72,4 | 73,1 | 74,4 | 69,9 |
| 12 | 16,9 | 16,5 | 15,5 | 15,6 | 14,7 | 14,5 | 15,8 | 15,3 | 15,9 | 14,5 | 14,7 | 15,3 |
| 13 | 68,3 | 71,4 | 73,0 | 75,3 | 74,4 | 75,2 | 73,0 | 71,8 | 78,5 | 78,8 | 78,4 | 75,9 |
| 14 | 25,0 | 26,6 | 27,3 | 28,0 | 25,8 | 26,7 | 27,2 | 26,4 | 30,3 | 28,3 | 27,5 | 28,9 |
| 15 | 46,2 | 49,1 | 42,6 | 44,9 | 42,4 | 44,4 | 43,4 | 43,8 | 46,0 | 44,5 | 48,9 | 46,6 |
| 16 | 9 | (10) | 7 | 6(+1) | 8 | 7 | 7 | 7 | 7 | 8 | 7 | 8 |
| 17 | 8+ | (9) | 7 | 6(+1) | 9 | 7 | 7 | 7 | 7 | 8 | 8 | 8 |
| 18 | 21,4 | 26,6 | 19,4 | 17,5 | 25,0 | 20,4 | 19,9 | 21,2 | 21,8 | 24,3 | 19,4 | 24,2 |
| 19 | — | 25,8 | 18,9 | 18,6 | 26,8 | 19,9 | 19,9 | 21,6 | 22,1 | 23,3 | 21,1 | 24,2 |
| 20 | 25,8 | 28,1 | 23,2 | 24,1 | 27,3 | 26,2 | 26,0 | 25,9 | 27,0 | 29,7 | 26,0 | 28,5 |
| 21 | 25,8 | 27,8 | 22,5 | 24,4 | 29,3 | 26,1 | 25,2 | 25,9 | 27,0 | 28,2 | 26,8 | 28,5 |
| 22 | 10 | — | 8 | 6+ | 9 | 8 | 7 | 7 | 9 | — | 9 | 9 |
| 23 | 10 | — | 8 | — | 9 | 8 | 8 | 7 | 9 | — | 10 | 9 |
| 24 | 23,5 | — | 23,7 | — | 25,0 | 23,4 | 21,2 | 19,1 | 25,2 | — | 23,9 | 23,9 |
| 25 | 23,2 | — | 23,5 | — | 23,8 | 22,8 | 21,7 | 20,9 | 24,7 | — | 24,9 | 23,5 |
| 26 | 23,5 | — | 25,9 | — | 26,1 | 24,6 | 22,4 | 20,7 | 26,2 | — | 24,3 | 25,1 |
| 27 | 23,5 | — | 25,9 | 21,4 | 25,0 | 25,1 | 23,9 | 22,2 | 25,6 | — | 25,6 | 25,1 |
| 28 | 78,3 | — | 84,2 | 84,1 | 83,1 | 81,2 | 79,6 | 82,6 | 81,1 | — | 81,9 | 81,3 |
| 29 | 22,7 | — | 24,9 | 23,6 | 23,6 | 22,3 | 22,1 | 22,4 | 23,2 | — | 24,2 | 23,5 |
| 30 | 9,2 | — | 12,2 | 11,0 | 10,1 | 12,5 | 10,9 | 10,9 | 10,7 | — | 11,4 | 11,7 |
| 31 | 21,7 | 16,8 | 20,3 | 20,3 | 19,3 | 17,4 | 18,2 | 19,1 | 18,0 | 17,9 | 19,2 | 21,1 |
| 32 | 13,5 | 14,6 | 14,9 | 14,9 | 14,7 | 14,0 | 16,1 | 13,4 | 11,3 | 16,1 | 13,9 | 14,5 |
| 33 | 21,6 | 27,4 | 24,2 | 24,7 | 22,4 | 26,7 | 23,5 | 22,7 | 26,5 | 27,9 | 27,5 | 28,6 |
| 34 | 42,7 | (37,9) | 44,7 | 43,6 | 42,7 | 58,5 | 42,3 | 41,3 | 44,2 | 46,1 | 40,7 | 44,5 |
| 35 | 45+ | — | 42 | 45 | — | — | — | 44+ | 49 | — | 52 | — |
| 36 | 44+ | — | 42 | 45 | — | — | 47 | 45+ | 47+ | — | — | — |

( ) denotes approximate measurement.
* 5 mm added for breakage on condyles.

southern African coast a stranding of *G. melaena* has been recorded as far east as East London and an overlap in the distributions of this species and *G. macrorhynchus* occurs in eastern Cape waters (van Bree *et al.*, 1978). In this region sightings of *Globicephala* species are rare, and no animals identifiable as *G. melaena* have been sighted on the SE coasts; off the west coast, however, spotter aircraft reported 21 sightings in two whaling seasons of which at least three schools were *G. melaena*, which may indicate that this species is more common off the west coast (van Bree *et al.*, 1978).

There is insufficient information to analyse seasonal movements of *G. melaena* off southern Africa, though the sightings off the west coast referred to above were made in all months between March and November, suggesting that these whales may be resident.

## ***Globicephala macrorhynchus*** Gray, 1846
## Short-finned Pilot Whale

*Phocoena globiceps* A. Smith (not Cuvier, 1812), 1834: 238.
*Globiocephalus macrorhynchus* Gray, 1846: 33 (type locality, South Seas).
*Globicephalus macrorhynchus* Sclater, 1901: 200; Fitzsimons, 1920: 224.
*Globicephala melaena* Roberts, 1951: 225 (in part).
*Globicephala macrorhyncha* Ellerman, Morrison-Scott and Hayman, 1953: 333; Best, 1971: 5.
*Globicephala macrorhynchus* Van Bree, Best and Ross, 1978: 1.

### Records and material

Data for 15 specimens of *G. macrorhynchus* from the SE coast are given in Table 61.

### Specific status and characters

A study of specimens of *Globicephala* from the Atlantic and Indian Oceans (Fraser, 1950b) showed that *G. macrorhynchus* was a valid species distinguished from *G. melaena* by its

Table 61:

Records and material of *Globicephala macrorhynchus* from the SE coast of southern Africa.

| Catalogue Number | Sex | Total length (mm) | CBL (mm) | Date | Locality | Comments |
|---|---|---|---|---|---|---|
| — | — | — | — | — | Mossel Bay area? | Skull without data in Mossel Bay Museum. |
| BMNH 53.9.18.26 | — | 1 680 | 368 | before 1834 | SE coast of South Africa | Type of *P. globiceps* Smith. |
| — | — | 2 210 | — | 09.08.47 | Morgan's Bay | Cast in ELM. One of 16 animals stranded. |
| PEM 1496/68 | ♂ | *c.* 6 100 | 744 | 10.07.62 | Seaview | Skull in PEM. |
| PEM 1496/69 | — | 4 110 | 597 | 14.05.63 | Jeffrey's Bay | Skull in PEM. |
| PEM 1515/30 | ♀ | 3 770 | 603 | 09.04.70 | Beachview | Skull in PEM. |
| PEM 1515/36 | ♀ | 3 960 | 582 | 09.04.70 | Beachview | Skull in PEM. |
| PEM 1515/37 | ♀ | 4 050 | 602 | 09.04.70 | Beachview | Skull in PEM. |
| PEM 1515/38 | ♂ | 5 130 | 712 | 09.04.70 | Beachview | Skull in PEM. |
| PEM 1515/39 | ♂ | 4 370 | 656 | 09.04.70 | Beachview | Skull in PEM. |
| PEM 1515/40 | ♂ | 5 080 | — | 09.04.70 | Beachview | Stranded with five whales listed above. |
| PEM 1516/87 | ♀ | — | 590 | 08.04.71 | Port Alfred | Skull in PEM. |
| PEM 1516/88 | ♀ | *c.* 4 100 | 603 | 08.04.71 | Port Alfred | Skull in PEM. |
| PEM 1516/89 | ♂ | 5 200 | — | 08.04.71 | Port Alfred | Teeth in PEM. |
| PEM 1520/12 | — | 5 890 | — | 17.08.71 | Cape Receife | Measurements only. Flipper length 16,4 per cent TL. |
| ELM— | — | — | 688 | — | East London area? | Skull on loan to PEM. |

shorter flippers (14–19% of total body length), broad premaxillae which entirely cover the maxillae distally and a smaller number of teeth (normally seven to nine teeth in each row). Subsequently van Bree (1971d) has shown that the North Pacific forms *G. sieboldii* Gray, 1846 and *G. scammoni* Cope, 1869 are junior synonyms of *G. macrorhynchus* and that this species occurs in the tropical and warm subtropical waters of the Atlantic and Indo-Pacific Oceans.

No differences of significance could be found between skull measurements of *G. macrorhynchus* given by Fraser (1950b), Kasuya (1975) and those of skulls in the present study (Table 60).

### DESCRIPTION

A 5,21 m adult male *G. macrorhynchus*, PEM 1516/89, is illustrated in Fig. 19; (as the flipper of this specimen had been removed before it could be examined, this has been drawn from another adult male, PEM 1515/40).

Externally this species is very similar in appearance to *G. melaena* but is most readily distinguished by the length of the flippers. In the present material the flipper length ranged from 14,8–17,8% of total body length. Descriptions of other features are given under *G. melaena* and external measurements for both species are provided in Table 59.

*G. macrorhynchus* is almost entirely black in colour except for a dark grey anchor-shaped mark on the ventral surface between the flippers and extending to the base of each flipper and posteriorly along the midline to the ano-genital region. This midventral grey colour was present in all six animals stranded at Beachview near Port Elizabeth on 9 April 1970, the only specimens examined immediately after stranding. The absence of the grey colour in the Port Alfred specimens was probably due to *post mortem* darkening. The pronounced greyish saddle posterior to the dorsal fin described for *G. scammoni* (= *G. macrorhynchus*) off California (Sergeant, 1962a; Mitchell, 1975) was neither seen on the Beachview specimens nor on any other southern African *G. macrorhynchus* examined to date.

The rostrum of the skull is short (about 50% CBL) and extremely broad. The distal portions of the premaxillae are expanded laterally leaving an uncovered strip of the maxillae less than 10 mm in width on each side. The tooth rows are short and restricted to the anterior portions of the jaws. The upper tooth row is usually less than 50% of the rostral length (range 32,5–55,4%; Table 60) and the lower tooth row is less than 35% of the mandible length (range 27,6–35,3%; Table 60). There are seven to 10 teeth in each tooth row. The most usual number in the southern African specimens was seven or eight.

No skeletal material from southern African specimens has been collected. The vertebral formulae of two specimens from the south eastern United States were C7 T11 L11 Cd28 = 57, and C7 T10 L12 Cd26(+2?) = 55 or 57 (True, 1889).

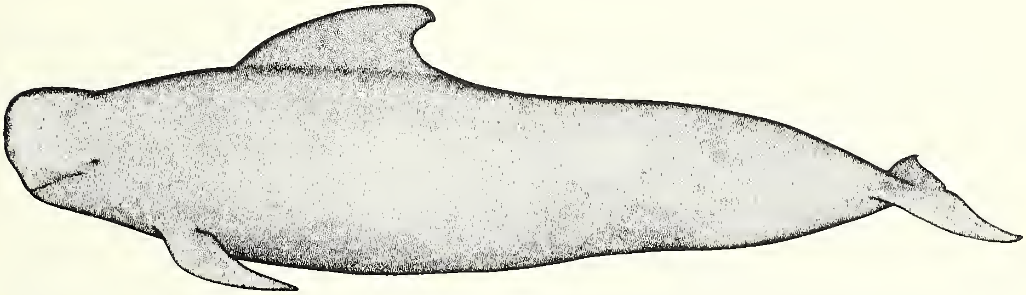


Fig. 19. Adult male *Globicephala macrorhynchus*, 5,21 m in length, from the eastern Cape (PEM 1516/89). (see note in text).

### BIOLOGY

*Age determination:* Teeth from eight animals were sectioned for age estimation and the results are given in Table 62.

Sergeant (1959) who examined two teeth of this species from Florida noted the extensive secondary dentine which forms in the pulp cavity. In the present material secondary dentine begins to appear after eight to 11 growth layers have been deposited.

*Growth and development:* The length at birth is uncertain. Sergeant (1959) noted that it is similar to that of *G. melaena*, that is about 1,70 m. However, Caldwell *et al.* (1971b) reported a 1,22 m animal stranded with four other *G. macrorhynchus* in South Carolina and Cadenat (1947) noted near-term foetuses of 1,2 m, 1,3 m and 1,45 m that had been aborted during stranding. The few figures suggest a length at birth of about 1,4 m.

The 5,89 m male, PEM 1520/12, appears to be the longest *G. macrorhynchus* recorded.

TABLE 62:

Numbers of growth layers in the dentine of eight *Globicephala macrorhynchus* teeth from the SE coast of southern Africa.

| Catalogue Number | Sex | Total length (mm) | Number of growth layers | Comments |
|---|---|---|---|---|
| PEM 1515/30 | ♀ | 3 770 | 6 | Pulp cavity open. |
| PEM 1515/36 | ♀ | 3 960 | 14 | Pulp cavity open. Secondary dentine from layer 8. |
| PEM 1516/87 | ♀ | *c.* 4 000 | 11+ | Pulp cavity closed. Secondary dentine from layer 11. |
| PEM 1515/37 | ♀ | 4 050 | 11 | Pulp cavity open. Secondary dentine from layer 8. |
| PEM 1516/88 | ♀ | *c.* 4 100 | 11 | Pulp cavity open. Secondary dentine from layer 9. |
| PEM 1515/39 | ♂ | 4 370 | 12 | Pulp cavity open. Secondary dentine from layer 8. |
| PEM 1515/38 | ♂ | 5 130 | 14 or 15 | Pulp cavity open. Secondary dentine from layer 10. |
| PEM 1516/89 | ♂ | 5 200 | *c.* 13 | Pulp cavity closed. Secondary dentine from layer 10. |

Similar lengths are attained by males in the eastern Pacific (5,65 m; Norris and Prescott, 1961) and northern Indian Ocean (5,5–5,75 m; Alagarswami *et al.*, 1973). In the tropical North Atlantic, however, there appear to be no records of males longer than 5,35 m (Mitchell, 1975; Caldwell and Golley, 1965), though Kritzler (1952) referred to lengths of "more than nineteen feet" (5,8 m) in a school of 46 whales stranded in Florida

Female *G. macrorhynchus* do not attain lengths of more than 4,3 m in the North Atlantic (Mitchell, 1975; Caldwell and Golley, 1965; Caldwell *et al.*, 1971b). Lengths of females from southern Africa are comparable (up to 4,1 m) though the available sample of four is very small. In the northern Indian Ocean lengths of up to 4,5 m have been recorded (Alagarswami *et al.*, 1973) and in the eastern Pacific females reach lengths of 4,7–4,8 m (Norris and Prescott, 1961; Hall *et al.*, 1971; Walker, 1975b).

*Reproduction:* Data from the ovaries of three females are provided in Table 63.

The lengths of these females suggest that sexual maturity occurs at about 3,8 m or 3,9 m in southern African *G. macrorhynchus*. Females from the eastern Pacific and New Guinea were immature at lengths of up to 3,36 m and 3,6 m respectively (Harrison *et al.*, 1972). In the North Atlantic females attain sexual maturity at legnths of 3,0–3,2 m (Mead, *in* Mitchell, 1975); Harrison *et al.* (1972) records two mature females of 3,35 m and 3,55 m in length from Florida.

TABLE 63:

Ovarian data for three *Globicephala macrorhynchus* and five *Grampus griseus* from the SE coast of southern Africa.

| Catalogue Number | Total length (mm) | No. of dentine growth layers | Ovarian | | Corpus luteum diameter (mm) | Corpora albicantia diameter (mm) and index | Total No. of corpora | Comments |
|---|---|---|---|---|---|---|---|---|
| | | | dimensions (mm) | mass (g) | | | | |
| *G. macrorhynchus* | | | | | | | | |
| PEM 1515/30 | 3 770 | 6 | 41×31×14 | 7,6 | — | — | 0 | Immature. Few developing follicles up to 3 mm diam. |
| | | | 46×23×10 | 8,1 | — | — | 0 | |
| PEM 1515/36 | 3 960 | 14 | 46×20×18(L) | 10,2 | — | 14(2016); 11 (550); 9(324) | 3 | Few small follicles. |
| | | | 40×25×13(R) | 7,1 | — | 11(792) | 1 | Few small follicles. |
| PEM 1515/37 | 4 050 | 11 | 60×26×14(L) | 15,7 | — | 14(490) | 1 | Several atretic follicles. Developing follicles up to 5 mm. |
| | | | — (R) | 12,7 | 17×17×14 | — | 1 | Corpus luteum 3,4 g. Not lactating. |
| *G. griseus* | | | | | | | | |
| PEM 1520/75 | 2 120 | <1 | 32×12×7 | 1,4 | — | — | 0 | No follicles seen in either ovary. |
| | | | 36×12×7 | 1,4 | — | — | 0 | Ovaries wrinkled. |
| PEM 1520/68 | 2 540 | 2+ | 33×13×6 | 1,6 | — | — | 0 | Few follicles up to 1 mm diameter in both. |
| | | | 34×14×9 | 1,9 | | | 0 | Ovaries smooth. |
| PEM 1515/78 | 2 560 | 5 | 35×10×7 | 1,5 | — | — | 0 | Several follicles up to 1 mm diameter in both. |
| | | | 37×12×7 | 1,8 | — | — | 0 | Ovaries smooth. |
| PEM 1518/73 | 2 570 | 4 | 55×14×6 | 3,3 | — | — | 0 | Few follicles up to 1 mm diameter in both. |
| | | | 57×11×7 | 2,9 | — | — | 0 | Ovaries wrinkled. |
| PEM 1515/73 | (2 905) | 9+ | 61×17×13(L)* | 35,2 | 48×39×22 | 7(112) | 2 | Corpus luteum 26,8 g. |
| | | | 64×18×8(R) | 7,0 | — | — | 0 | Several follicles up to 2 mm diameter in both. |

( ) denotes estimation of total length from CBL
* measurements exclude corpus luteum.

There are no data on foetuses from southern Africa. Foetal lengths from mass strandings in the North Atlantic suggest an extended calving season (Cadenat, 1947; Mitchell, 1975).

Reproductive details for four males from southern Africa are given in Table 56. The presence of sperm in the testes of the three smallest males indicates that they were sexually mature. Comparison of the smaller testis weight of each pair from these four specimens with the curve for testis mass/body length of *G. melaena* (Sergeant, 1962b) also suggests that all four animals were sexually mature. The length of the smallest male (4,37 m) is considerably less than the length at which males reach sexual maturity in the North Atlantic (about 4,8 m) (Mead, *in* Mitchell, 1975) and it is probable that this animal was not functionally mature, though some spermatogenesis was observed histologically.

*Food and feeding:* The stomachs of seven animals were examined in this study. Three of these were empty. Cephalopod remains were noted in stomachs of four of the animals stranded at Beachview. Beaks collected from one of these animals (PEM 1515/37) were identified as those of *Loligo reynaudi* (24 specimens) and *Oregoniateuthis* sp. (10 specimens).

There are few references to the food of *G. macrorhynchus* in the literature. Norris *et al.* (1965) recorded this species feeding on spawning *Loligo opalescens* off southern California close to the coast. The whales were thought to have been feeding to a depth of 366 m. Hall *et al.* (1971) implicated the presence of spawning squid close inshore as a causative factor in a mass stranding of *G. scammoni* (=*macrorhynchus*). Caldwell *et al.* (1971a) reported that squid and fish were found in *G. macrorhynchus* killed in the Lesser Antilles, and noted that there is at times an association between the presence of these whales and of tuna. A similar association occurs off Puerto Rico in that the appearance of these whales coincides with that of the tuna (Caldwell and Erdman, 1963). Similarly, this species has been seen feeding in association with tuna on the squid *Illex illecebrosus coindeti* on the West African coast (Postel, *in* Sergeant, 1962b).

*School size:* Schools containing two or more individuals of this species have stranded fairly frequently. The mean school size for 20 such strandings in the Atlantic and Indian Oceans is 36 (range 3–151) (present study; Alagarswami *et al.*, 1973; Cadenat, 1947; Caldwell and Golley, 1965; Caldwell *et al.*, 1970; Caldwell *et al.*, 1971b; Fehring and Wells, 1976). The mean size of schools sighted at sea is considerably smaller than that of those stranded being 15 for 53 schools reported in the literature (range 1–*c.*100) (Caldwell and Erdman, 1963; Erdman, 1970; Erdman *et al.*, 1973; Fiscus and Niggol, 1965; Taruski and Winn, 1976). Three schools of whales which were considered to be *G. macrorhynchus*, seen off the SE coast of southern Africa, contained two, 10 and *c.* 25 individuals (Table 54). These numbers are consistent with those recorded elsewhere.

## DISTRIBUTION AND MIGRATION

*G. macrorhynchus* is distributed through the tropical and warm-temperate waters of the North Atlantic, Indian and Pacific Oceans (Mitchell, 1975). The limits of its range in the tropical Atlantic and southern Pacific regions are poorly known.

Indian Ocean records include those from India and Indonesia (Alagarswami *et al.*, 1973), the Seychelles (de Smet, 1975) and the 15 southern African specimens reported here. Le Barbier (1908) noted that *G. melas* (= *melaena*) was common in the district of Tulear on the west coast of Madagascar. These animals were probably *G. macrorhynchus* but the record requires confirmation.

In southern African waters *G. macrorhynchus* is recorded as far westwards as Jeffrey's Bay (25° E) and, with a probable record, from Mossel Bay (22° E). In this region its distribution overlaps with that of *G. melaena* which is recorded as far eastward as East London (28° E) (van Bree *et al.*, 1978).

There are too few records to judge whether *G. macrorhynchus* migrates seasonally on the southern African coast. The known records are all in the cooler months of April, May, July, and August.

### Genus *GRAMPUS* Gray, 1828

*Spicilegia Zoologica,* 1: 2; type species *Delphinus griseus* Cuvier by selection.

These are large dolphins attaining up to 4 m in length. The head is globose and the melon is well-developed. There is no beak. Two to seven pairs of teeth are present in the lower jaw only. The flippers are long and narrow. The dorsal fin is high, erect and falcate, set at the mid-length of the body.

The rostrum of the skull is broad, tapering to an obtuse apex. The prenarial area of the premaxillae is raised and convex.

A single species *Grampus griseus* Cuvier is recognized.

### ***Grampus griseus*** (Cuvier, 1812)

### Risso's Dolphin

*Delphinus griseus* Cuvier, 1812: 19 (holotype, skin and skull, Museum National d'Histoire Naturelle, Paris; type locality, Brest, France).

*Grampus griseus* Hamilton, 1837: 233; Sclater, 1901: 201; Fitz Simons, 1920: 224; Roberts, 1951: 225; Ellerman, Morrison-Scott and Hayman, 1953: 332; Barnard, 1954: 25; Best, 1971: 4.

*Grampus richardsonii* Gray, 1850: 85; 1865b: 522; 1866; 299.

#### RECORDS AND MATERIAL

Data for 23 specimens of *G. griseus* stranded on the SE coast of southern Africa are given in Table 64. The dates, numbers and localities of 26 sightings are listed in Table 65. The distribution of these records is mapped in Fig. 35.

#### SPECIFIC STATUS AND CHARACTERS

Studies by several workers in the latter part of the 19th century showed that specimens from the North Atlantic, North Pacific and South Africa were sufficiently similar to be grouped as a single species, *G. griseus*, (True, 1889). At that time only one specimen was known from southern Africa, a skull collected at Kalk Bay in False Bay, which Gray (1865) identified as a second example of *G. richardsonii.* This species was considered to differ from *G. griseus* in the narrower width of the rostrum and premaxillae. True (1889) has pointed out that there are adult specimens from the North Atlantic that have equally narrow rostra and premaxillae thereby inferring that normal variation could account for the narrowness of these bones in the Kalk Bay animal. This was a young animal about 2,44 m in length (Sclater, 1901). The rostral width measurements (Table 67, nos. 3, 4, 5, 6, and 33) of southern African specimens examined in this study show that these bones increase in width proportionately with age indicating that the relatively narrow rostrum of the specimen from Kalk Bay was a reflection of its youth.

It is clear that *G. richardsonii* is not a valid species but a junior synonym of *G. griseus.* No further differences of taxonomic significance were found in a comparison of the external and skull measurements of the present series (Tables 66, 67) and those of North Atlantic or North Pacific specimens (Tomlin, 1957; Orr, 1966; Stroud, 1968; Pilleri and Gihr, 1969). Skull measurements of several specimens less than 2,8 m in length from Japan (Mizue and Yoshida, 1962) differed in some respects from those of the present series but it is uncertain whether these measurements were made in the same way for each sample.

TABLE 64:

Records and material of *Grampus griseus* from the SE coast of southern Africa.

| Catalogue Number | Sex | Total length (mm) | CBL (mm) | Date | Locality | Comments |
|---|---|---|---|---|---|---|
| — | ♂ | — | — | pre. 1930 | Swartkops River Mouth | Photographs in PEM. |
| ELM 616 | — | — | 498 | 31.05.58 | Mazeppa Bay | Skull in PEM. |
| PEM 1513/103 | ♀ | 2 770 | 500 | 21.06.58 | Cape Receife | Skull in PEM. Carrying a 0,56 m ♂ foetus. |
| ELM 745 | — | — | — | 18.11.62 | Buffalo River, East London | Skull in PEM. |
| PEM 1514/13 | — | — | 520 | 07.08.66 | Cape Receife | Skull in PEM. |
| PEM 1514/33 | — | — | 530 | 20.12.68 | 4 km E of Gamtoos River Mouth | Skull in PEM. Decomposing carcase. |
| PEM 1515/04 | ♂ | 2 425 | 464 | 16.10.69 | Durban | Alive at Durban Aquarium for 4 days. Emaciated. |
| PEM 1515/60 | — | — | — | 30.06.70 | 5 km W of Woody Cape | Mandibles only found on beach. Symphysis fused. |
| PEM 1515/72 | ♂ | 2 580 | 497 | 23.09.70 | 2 km E of Woody Cape | Skull in PEM. |
| PEM 1515/73 | ♀ | — | 522 | 01.10.70 | 2 km W of Sardinia Bay | Skull in PEM. Tail cut off. Length estimated from other measurements. |
| PEM 1515/78 | ♀ | 2 560 | 488 | 24.10.70 | Sardinia Bay | Skull in PEM |
| PEM 1515/89 | ♂ | — | 542 | 03.11.70 | Sundays River Mouth | Skull in PEM. Decomposing carcase. |
| — | ♀ | *c.* 3 000 | — | 05.12.70 | Seaview | Photographs in PEM. |
| PEM 1519/89 | — | 840 | — | June–July 1971 | Natal North Coast | Foetus taken from stranded ♀. |
| ELM 909 | ♂ | — | 503 | 09.08.73 | Haga Haga | Skull in PEM. |
| PEM 1518/73 | ♀ | 2 570 | 487 | 03.09.73 | 4 km E of Gamtoos River Mouth | Skull in PEM. |
| PEM 1518/86 | — | 2 950 | 546 | March 1974 | Springmount, Algoa Bay | Skull in PEM. Decomposing carcase. |
| PEM 1519/91 | — | — | 481 | 1975 | 2 km E of Kwaaihoek | Skull in PEM. Bleached skeleton found in the dunes. |
| PEM 1519/24 | ♂ | 1 630 | 356 | May 1975 | Thysbaai | Skull in PEM. Stranding probably occurred in April. |
| PEM 1519/90 | ♂ | 3 250 | 501 | Dec. 1975 | Seaview | Skull in PEM. Stranding probably occurred in November. |
| PEM 1520/36 | ♂ | 1 630 | — | *c.* Sept. 1976 | Natal Coast | Month of death uncertain. |
| PEM 1520/68 | ♀ | 2 540 | 483 | 05.09.77 | Cannon Rocks | Skull and cast in PEM. Stranded alive. |
| PEM 1520/75 | ♀ | 2 120 | 418 | 17.09.77 | Kromme River | Skull in PEM. Stranded alive. |

TABLE 65:

Sight records of *Grampus griseus* from the SE coast of southern Africa. Data from photographs in PEM files, Gambell *et al.* (1975) and IOS (1969, 1971, 1972, 1973, 1975).

| Date | Number | Locality |
|---|---|---|
| 25.08.69 | 10 | 30° 28′S, 33° 03′E |
| 31.01.71 | 10 | 29° 28′S, 32° 15′E |
| 31.01.71 | 20 | 29° 11′S, 32° 20′E |
| 31.01.71 | 2 | 29° 11′S, 32° 20′E |
| 06.02.71 | 10 | 30° 19′S, 31° 42′E |
| 07.02.71 | 3 | 30° 25′S, 31° 23′E |
| 19.02.71 | 6 | 29° 48′S, 32° 15′E |
| 08.02.72 | 12 | 31° 45′S, 30° 08′E |
| 12.02.72 | 7 | 30° 08′S, 31° 57′E |
| 01.02.73 | 14 | 30° 21′S, 31° 52′E |
| 21.02.73 | 3 | 30° 52′S, 31° 31′E |
| 24.11.73 | 6 | 30° 55′S, 32° 38′E |
| 24.11.73 | 3 | 31° 03′S, 32° 51′E |
| 01.02.74 | 40 | 33° 50′S, 35° 00′E |
| late 1974 | — | *c.*34° 50′S, 25° 40′E |
| 20.01.75 | 7–10 | 34° 21′S, 26° 09′E |
| 21.01.75 | 15 | 34° 43′S, 25° 19′E |
| 21.01.75 | 15 | 34° 46′S, 25° 15′E |
| 21.01.75 | 4 | 34° 48′S, 25° 13′E |
| 21.01.75 | 13 | 34° 47′S, 24° 47′E |
| 21.01.75 | 3 | 34° 53′S, 24° 38′E |
| 21.01.75 | 10 | 34° 55′S, 24° 36′E |
| 21.01.75 | 3–4 | 34° 57′S, 24° 33′E |
| 22.01.75 | 10 | 35° 30′S, 23° 22′E |
| 22.01.75 | 5 | 36° 21′S, 22° 58′E |
| 31.01.75 | 4–6 | 31° 14′S, 32° 37′E |

## DESCRIPTION

A 2,54 m female, PEM 1520/68, is illustrated in Fig. 20. The semicircular scars on the flank of this animal result from a healed shark bite.

The anterior half of the body of *G. griseus* is robust and slightly compressed laterally. Posterior to the dorsal fin the body is attenuate in profile and becomes increasingly compressed

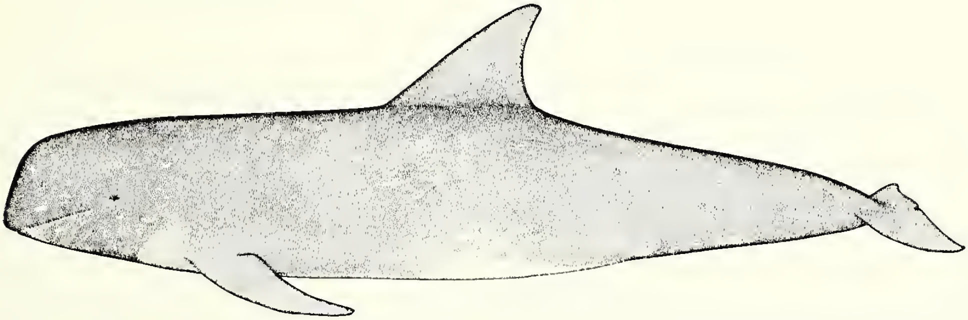


Fig. 20. Subadult female *Grampus griseus*, 2,54 m in length, from the eastern Cape (PEM 1520/68). (Note the healed shark bite on the flank).

Table 66:

External measurements in mm of 10 *Grampus griseus* from the SE coast of southern Africa. Measurement numbers are keyed to Table 2.

| Meas. Nos. | PEM 1519/24 | PEM 1520/36 | PEM 1520/75 | PEM 1515/04 | PEM 1520/68 | PEM 1515/78 | PEM 1518/73 | PEM 1515/72 | PEM 1513/103 | PEM 1519/90 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 630 | 1 630 | 2 120 | 2 425 | 2 540 | 2 560 | 2 570 | 2 580 | 2 770 | 3 250 |
| 2 | 230 | 230 | 265 | 345 | 305 | 360 | 290 | 360 | — | (280) |
| 4 | 165 | 185 | 205 | 265 | 240 | 280 | 230 | 270 | 305 | (240) |
| 5 | — | — | 350 | 455 | — | 440 | — | — | — | — |
| 6 | — | — | 90 | 140 | — | 90 | — | — | — | — |
| 7 | 70 | 50 | 75 | 75 | 80 | 80 | 85 | 90 | — | — |
| 8 | 200 | 170 | 235 | 240 | 300 | 240 | 300 | 280 | — | — |
| 9 | 240 | 225 | 295 | 380 | 340 | (300) | 310 | — | — | — |
| 10 | 370 | 360 | 415 | 535 | 520 | 530 | 490 | 550 | — | 520 |
| 11 | 730 | 700 | 950 | — | 1 080 | — | 1 160 | — | — | 1 310 |
| 12 | 950 | 920 | 1 245 | 1 500 | 1 470 | 1 540 | 1 620 | 1 620 | — | 1 840 |
| 13 | 730 | 700 | 895 | 1 065 | 1 110 | 1 110 | — | 1 110 | — | — |
| 14 | 930 | 910 | 1 310 | 1 395 | 1 590 | 1 670 | 1 620 | 1 510 | — | — |
| 15 | 1 100 | 1 030 | 1 370 | 1 600 | 1 700 | 1 710 | 1 730 | 1 750 | — | — |
| 16 | — | −10 | −12 | −25 | −35 | −25 | −40 | −30 | — | — |
| 18a | — | — | 20 | — | — | 35 | — | — | — | — |
| b | — | — | 12 | — | — | 15 | — | — | — | — |
| c | — | — | 12 | — | — | 20 | — | — | — | — |
| 20 | — | 760 | 940 | 1 015 | 1 200 | 1 260 | — | 1 440 | — | — |
| 21 | — | 780 | 980 | 1 015 | — | 1 300 | — | — | — | — |
| 22 | — | 460 | 520 | 635 | 740 | 740 | 740 | 800 | — | — |
| 23 | — | 20 | 25 | 25 | 25 | 25 | — | 30 | — | — |
| 24a | — | — | 22 | — | 33 | 35 | 35 | — | — | — |
| b | — | — | 22 | — | 33 | 35 | 35 | — | — | — |
| 25a | — | 120 | — | 241 | — | 260 | 160 | — | — | — |
| b | — | 90 | — | 135 | — | 40 | — | — | — | — |
| c | — | — | 220 | — | 250 | — | — | — | — | — |
| 26 | 25 | 35 | 45 | 30 | 45 | 45 | 45 | 60 | — | — |
| 27 | (280) | 320 | 365 | 455 | 485 | 470 | 490 | 500 | 495 | — |
| 28 | (220) | 230 | 265 | 355 | 375 | 360 | (380) | 350 | — | — |
| 29 | 75 | 90 | 110 | 140 | 145 | 140 | 140 | 140 | 165 | — |
| 30 | (150) | 170 | 185 | 280 | 320 | 390 | 290 | 360 | 355 | (270) |
| 31 | (250) | 260 | 320 | 355 | 440 | 260 | 480 | 420 | — | (440) |
| 32 | 300 | 330 | 405 | 585 | 590 | 570 | 540 | 570 | 710 | — |
| 33 | 100 | 125 | 125 | 175 | 180 | 170 | — | 180 | — | — |
| 34 | (20) | 30 | 25 | 25 | 30 | 35 | 45 | 40 | — | — |

(  ) denotes approximate measurement.

laterally towards the flukes. The head is rounded and slopes steeply anteriorly to the tip of the snout which projects beyond the tip of the lower jaw. The beak is scarcely perceptible. The gape is slightly oblique to the long axis of the body. The anterior face of the melon has a characteristic median longitudinal furrow which is present in specimens of all ages including the 0,56 m foetus of PEM 1513/103.

The dorsal fin is high (8–15% of total length), erect, broad at its base and set at about midlength of the body. Its leading edge is straight or slightly convex and the trailing edge is moderately concave. The flippers are long and narrow (17–20% and 5–7% of total length respectively) and have a convex leading edge and a concave trailing edge. They are broadest close to their insertion and taper distally to a pointed apex. The flukes are broad and full and taper distally to their rounded tips.

TABLE 67:

Skull measurements of 18 *Grampus griseus* from the SE coast of southern Africa. Condylobasal length (measurement 1) and tympanic bulla lengths (measurements 35, 36) are in mm. Other measurements are expressed as percentages of CBL. Measurement nos. are keyed to Table 6.

| Meas. No. | PEM 1519/24 | ELM 745 | PEM 1520/75 | PEM 1515/04 | PEM 1519/91 | PEM 1520/68 | PEM 1518/73 | PEM 1515/78 | PEM 1515/72 | ELM 616 | PEM 1513/103 | PEM 1519/90 | ELM 909 | PEM 1514/13 | PEM 1515/73 | PEM 1514/33 | PEM 1518/89 | PEM 1518/86 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 356 | 409 | 418* | 464 | 481 | 483 | 487 | 488 | 497 | 498 | 500 | 501 | 503 | 520 | 522 | 530 | 542** | 546 |
| 2 | 48,3 | 50,1 | 48,6 | 48,5 | 54,3 | 56,1 | 51,1 | 52,7 | 52,5 | 52,2 | 51,6 | 50,3 | 49,1 | 51,0 | 53,8 | 52,1 | 50,4 | 51,8 |
| 3 | 32,9 | 35,5 | 37,1 | 37,9 | 38,0 | 36,9 | 37,2 | 37,3 | 39,4 | 38,6 | 40,6 | 41,3 | 39,6 | 37,5 | 38,7 | 39,6 | 36,5 | 39,7 |
| 4 | 22,2 | 29,8 | 30,6 | 35,6 | 35,8 | 34,4 | 34,5 | 34,6 | 35,0 | 33,7 | 38,0 | 37,3 | 39,4 | 35,4 | 36,2 | 35,8 | 34,7 | 38,3 |
| 5 | 18,3 | 22,5 | 22,2 | 25,2 | 23,5 | 21,9 | 23,4 | 22,7 | 23,1 | 23,7 | 24,6 | 25,9 | 26,2 | 25,2 | 22,2 | 24,7 | 23,6 | 25,6 |
| 6 | 12,6 | 14,2 | 15,8 | 17,7 | 17,3 | 17,0 | 17,2 | 16,8 | 16,7 | 16,7 | 17,0 | 17,2 | 19,9 | 17,1 | 16,3 | 16,0 | 17,2 | 17,4 |
| 7 | 61,8 | 65,3 | 63,9 | 65,9 | 69,2 | 69,8 | 67,8 | 67,6 | 70,0 | 69,9 | 68,8 | 66,5 | 66,0 | 66,0 | 70,3 | 67,4 | 68,5 | 68,5 |
| 8 | 57,6 | 61,1 | — | 60,8 | 59,9 | 63,4 | 60,8 | 62,9 | 60,8 | — | 62,4 | 58,5 | 61,0 | 63,1 | 62,1 | 64,5 | 61,1 | 61,4 |
| 9 | 52,9 | 60,6 | 59,1 | 63,1 | 64,4 | 61,5 | 63,7 | 61,1 | 63,0 | 64,3 | 64,4 | 64,5 | 62,2 | 60,6 | 61,7 | 64,5 | 60,9 | 65,8 |
| 10 | 56,7 | 62,3 | 62,9 | 65,1 | 66,5 | 63,1 | 66,1 | 64,5 | 65,0 | 68,1 | 67,4 | 68,3 | 67,0 | 62,7 | 65,1 | 67,5 | 65,9 | 68,1 |
| 11 | 53,4 | 60,6 | 58,4 | 60,6 | 63,4 | 60,0 | 62,0 | 58,8 | 59,8 | 62,9 | 62,2 | 64,3 | 63,0 | 59,2 | 60,3 | 61,3 | 59,6 | 63,6 |
| 12 | (15,7) | 15,2 | 14,6 | 12,5 | 14,3 | 13,5 | 12,5 | 14,3 | 14,5 | 14,1 | 14,8 | 14,0 | 13,1 | 12,1 | 12,1 | 14,9 | 12,9 | 12,5 |
| 13 | 57,3 | (61,9) | 62,7 | 65,3 | 66,9 | 63,1 | 66,5 | 65,2 | 65,4 | 69,9 | 67,6 | 68,7 | 68,0 | 62,5 | 65,7 | 67,4 | 66,2 | 70,0 |
| 14 | 25,2 | 26,4 | 23,4 | 23,7 | 24,1 | 22,8 | 22,8 | 25,4 | 25,6 | 26,1 | 24,4 | 23,6 | 24,7 | 23,5 | 22,2 | 23,4 | 22,5 | 23,6 |
| 15 | (50,6) | 44,7 | 43,8 | 42,7 | (43,7) | 40,4 | 43,5 | 40,2 | 40,4 | 44,6 | 40,2 | 41,7 | 40,6 | 41,3 | 44,1 | 41,5 | 40,2 | 39,7 |
| 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | 4 | 3 | 3 | 4 | — | 3 | 5 | 3 | 3 | — | 3 | 3 | 3 | 5 | 4 | 3 | 5 | 4 |
| 23 | 4 | 3 | 3 | 4 | — | 3 | 5 | 3 | 3 | — | 3 | 3 | 4 | 5 | 4 | 3 | 5 | 3 |
| 24 | (14,6) | 9,3 | 9,6 | 13,6 | — | 10,1 | 13,3 | 9,2 | 9,7 | — | 10,8 | 10,6 | 11,9 | 14,8 | 12,6 | 10,0 | 14,9 | 12,6 |
| 25 | (13,2) | 8,8 | 9,6 | 13,8 | — | 10,7 | 13,8 | 9,4 | 9,7 | — | 11,2 | 10,0 | 14,1 | 16,0 | 11,1 | 10,2 | 15,3 | 10,1 |
| 26 | (16,9) | 11,0 | 12,0 | 15,7 | — | 13,0 | 15,2 | 11,1 | 11,2 | — | 13,6 | 11,4 | 13,3 | 17,3 | 14,0 | 12,5 | 16,2 | 13,4 |
| 27 | (16,0) | 10,8 | 11,7 | 15,9 | — | 13,9 | 15,4 | 11,7 | 11,4 | — | 14,4 | 11,2 | 15,3 | 18,3 | 13,0 | 12,8 | 16,6 | 10,6 |
| 28 | (78,1) | 82,4 | 80,4 | 80,8 | — | 83,0 | 80,5 | 81,1 | 81,9 | — | 83,6 | 80,6 | 80,5 | 77,7 | 80,8 | 83,0 | 81,2 | 81,0 |
| 29 | — | 18,8 | 20,3 | 20,5 | — | 19,5 | 19,7 | 21,9 | 21,3 | — | 22,6 | 22,4 | 21,5 | 19,6 | 21,1 | 20,6 | 21,2 | 19,8 |
| 30 | 9,0 | 10,3 | 10,3 | 11,0 | — | 11,4 | 10,3 | 10,7 | 10,3 | — | 9,4 | 8,4 | 12,3 | 11,0 | 11,3 | 11,1 | 10,5 | 12,6 |
| 31 | — | 22,2 | 22,5 | 21,6 | 22,7 | 20,5 | 19,1 | 21,5 | 21,9 | 22,7 | 21,6 | 32,8 | 23,5 | 20,6 | 19,0 | 21,1 | 22,3 | 21,2 |
| 32 | — | 10,8 | 11,5 | 11,0 | 11,6 | 10,8 | 10,1 | 13,1 | 12,5 | 12,4 | 13,6 | 16,0 | 12,7 | 10,2 | 10,0 | 12,5 | 14,0 | 14,1 |
| 33 | 13,2 | (16,1) | 15,8 | 18,3 | 17,7 | 15,9 | 17,0 | 15,2 | 15,9 | 17,7 | 16,8 | 19,2 | 17,7 | 17,7 | 15,7 | 18,1 | 17,7 | 19,2 |
| 34 | (37,9) | 37,4 | 37,1 | 36,2 | 37,8 | (35,2) | 37,8 | (37,5) | (37,4) | 38,2 | (35,6) | (37,5) | 37,8 | 36,0 | 33,7 | (35,8) | (35,4) | (36,3) |
| 35 | — | — | 42 | — | — | 44 | 42 | 44 | 43 | — | 46 | 44 | — | 47 | 43 | — | — | — |
| 36 | — | — | 42 | — | — | 46 | 42 | 44 | 43 | — | 45 | 46 | — | 47 | 42 | — | — | — |

(  ) denotes approximate measurement.     * 10 mm added for damage to rostrum.     ** 20 mm added for damage to condyles.

*G. griseus* is dark grey or greyish black in colour over the entire dorsal surface and appendages. The head and flanks may be slightly paler in colour than the back. Ventrally, the anterior three-quarters of the throat between the tip of the lower jaw and the flipper insertion is dark grey. Posterior to this dark area a white patch extends caudally between the flippers and laterally anterior to the flipper insertions. The anterior margin of this patch is sharply demarcated and is approximately M-shaped in outline. The posterior margin is more diffuse, darkening through shades of grey to black. In the midline a greyish white streak runs posteriorly to join with a second ovoid white patch which extends from the umbilicus to the anal slit. The margins of both lips are whitish in colour.

Adult *G. griseus* are usually marked in varying degrees with elongate and circular white scars which are attributed to intraspecific fighting and to damage by cephalopods during feeding. Fraser (1974) noted that scarring is more intensive in older animals. Mizue and Yoshida (1962) indicated that greater scarring occurred on males than on females.

The skull is robust and depressed dorsally. The rostrum is about half the length of the skull, is broad at the base and tapers evenly from about 50 mm anterior to the antorbital notches to its obtuse, rounded apex. Anterior to the superior nares the premaxillae are elevated and moderately or strongly convex, except close to the tip of the rostrum where the mesial border of each premaxilla is raised and the dorsal surface becomes concave. On the rostrum the premaxillae are slightly elevated. The lateral margins of the premaxillae are subparallel, widely separated proximally and taper rapidly to two-thirds of rostral width at its midlength. The premaxillae narrow to a point in the distal quarter of the rostrum. The mesorostral canal is abruptly dilated in this portion of the rostrum. The tip of the rostrum is characteristically curved ventrally, though similar curvature was observed in two *Pseudorca crassidens* in PEM.

The number of teeth is diagnostic for this species. Teeth are absent from the upper jaw except in rare specimens (Harmer, 1927) in which one or two teeth may be found at the tip of the upper jaw. Upper teeth were absent in all southern African specimens examined in this study. The number of mandibular teeth varies from two to seven on each side. In the present material the range was three to five teeth; the most frequent count was 3:3 (eight specimens), followed by 4:4 and 5:5 (three specimens each) and 3:4 (two specimens).

The mandibular symphysis is short (8–12% CBL). It may be fused in larger specimens. In six of eight skulls examined of more than 500 mm CBL (excluding PEM 1514/13 and PEM 1515/73) the mandibular symphysis was partially but firmly fused.

The vertebral formulae of four southern African *G. griseus* were

PEM 1520/36: C7 T12 L20 Cd31 = 70;
PEM 1520/68: C7 T13 L18 Cd32 = 70;
PEM 1520/75: C7 T13 L18 Cd32 = 70;
PEM 1515/78: C7 T13 L21 Cd24(+2) = 65 (+2).

North Atlantic specimens have a total of 68 or 69 vertebrae (True, 1889). The vertebral column of PEM 1515/78 showed abnormal hypertrophy of the centra of vertebrae T5–10, L2–4, L8–13, L18–20, Cd2–5 and Cd12–13. Osteoporosis of the vertebral epiphyses had occurred between almost all of these vertebrae. Partial ankylosis of the epiphyses of vertebrae T5–7, L2–3, L8–9 and Cd3–5 with chevrons 3 and 4 had taken place.

## BIOLOGY

*Age determination:* Half teeth were prepared from three very young animals and thin sections of teeth were made for ten older specimens. These were examined in reflected and transmitted light respectively. Counts of dentine growth layers and other details are given in Table 68.

Generally the growth layers in these teeth were clear and easy to count. In some teeth all

TABLE 68:

Number of dentine growth layers and other data for teeth from 13 *Grampus griseus* from the SE coast of southern Africa.

| Catalogue Number | Total Length (mm) | Number of growth layers | Pulp cavity | Remarks* |
|---|---|---|---|---|
| PEM 1520/36 | 1630 | < 1 | Open | Neonatal dentine: 0,15 mm. |
| PEM 1519/24 | 1630 | < 1 | Open | Neonatal dentine: 0,175 mm. |
| PEM 1520/75 | 2120 | < 1 | Open | Neonatal dentine: 0,60 mm. |
| PEM 1515/04 | 2425 | 2+ | Open | Layer 1: 1,1 mm. Layer 3: 0,5 mm. Layers poorly defined. |
| PEM 1520/68 | 2540 | 2+ | Open | Layer 1: 1,1 mm. Layer 3: c.0,4 mm. Layers poorly defined. |
| PEM 1515/72 | 2580 | 2+ or 3 | Open | Layer 1: 0,8 mm. Layers poorly defined. |
| PEM 1518/73 | 2570 | 4 | Open | Layer 1: 1,0 – 1,1 mm. Fourth layer considered complete. Innermost zone translucent. |
| PEM 1515/78 | 2560 | 5 | Open | Layer 1: 1,1 mm. Layer 5: 0,3 mm, considered complete. |
| PEM 1515/73 | (2905) | 9+ | Open | Layer 1: 0,9 mm. Tenth layer incomplete. |
| ELM 909 | (2760) | 10+ | Closed | Layer 1: 1,2 mm. Layers counted to secondary dentine. |
| PEM 1514/33 | (2967) | 12+ | Closed | Layer 1: 1,0 mm. Layers counted to secondary dentine. |
| PEM 1515/89 | (3058) | 13+ | Open | Layer 1: 1,1 mm. Layers counted to secondary dentine. |
| PEM 1513/103 | 2770 | 17+ | Closed | Layer 1: 1,0 mm. Layers counted to secondary dentine. |

* measurements refer to thickness of dentine measured close to the apex of the pulp cavity.
( ) indicates that total length was estimated from CBL.

or parts of growth layers contained secondary but well defined zones which obscured the major zones. The presence of secondary dentine lining or filling the pulp cavity restricted counts in teeth of older animals.

*Growth and development:* The length at birth is uncertain. The amount of dentine deposition in the teeth of the two smallest calves, 1,63 m in length each, in the present material suggests that some growth had occurred since birth. Tomilin (1957) estimated the length at birth based on records of calves of 1,4 m and foetuses of up to 1,66 m to be about 1,5 m. Mizue and Yoshida (1962) estimated the length at birth to be 1,10–1,20 m in Japanese *G. griseus*.

The stomach of PEM 1520/75, 2,12 m in length, contained numerous cephalopod beaks which indicated that obligate suckling had ceased. The teeth of this animal had recently erupted and protruded about 1 mm above the surface of the gum. If tooth eruption coincides with the beginning of prey capture, it would imply that the two calves, 1,63 m in length each, in which the teeth had not yet erupted were actively suckling.

The longest specimen of *G. griseus* on record is a 4,089 m female which stranded in Britain (Fraser, 1974). The length of this animal is exceptional.

The length frequencies of eastern North Atlantic and Mediterranean *G. griseus* were found to have a median length of about 3,25 m. The length frequencies were obtained from a sample of 66 *G. griseus*, all of more than 2,4 m in length, from Britain, France, the North Sea and the Mediterranean (Duguy, 1976, 1977; Fraser, 1934, 1946, 1953, 1974; Harmer, 1927; Pilleri and Gihr, 1969; Tomilin, 1957) and are provided in Table 69. With one exception, these animals were strandings. No differences were found in the average lengths of 19 males and 14 females in this sample, when tested with the U-test of Mann-Whitney (Campbell, 1967).

The present material includes nine specimens of more than 2,4 m, of which the total lengths are known (Table 64). The total lengths of an additional seven specimens have been estimated from condylobasal length using a regression fitted by the least squares method of total length on condylobasal length for ten specimens from the SE coast—

$$Y = -1\,072 + 7{,}62\,X \ (r = 0{,}91)$$

where Y = total length (mm), X = CBL (mm).

The length frequencies of this increased sample of 16 specimens are shown in Table 69.

Table 69:

Length frequencies for *Grampus griseus* from the eastern North Atlantic, the Mediterranean, and the SE coast of southern Africa. Data sources are given in the text. The lengths given represent the lowest value of each class interval.

| Region | Lengths (m) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2,4 | 2,5 | 2,6 | 2,7 | 2,8 | 2,9 | 3,0 | 3,1 | 3,2 | 3,3 | 3,4 | 3,5 | 3,6 | 3,7 | 3,8 | 3,9 | 4,0 |
| eastern North Atlantic (n=57) | 4 | 2 | 1 | 4 | 2 | 3 | 7 | 2 | 11 | 9 | 4 | 2 | 3 | 1 | 1 | — | 1 |
| Mediterranean (n=9) | — | 1 | — | 1 | — | 3 | — | — | — | 2 | 1 | — | 1 | — | — | — | — |
| Southern Africa (n=16) | 1 | 5* | — | 3** | 2* | 3** | 1* | — | 1 | — | — | — | — | — | — | — | — |

* Includes one total length estimated from CBL.
** Includes two total lengths estimated from CBL.

Statistical comparison using the U-test of Mann-Whitney shows that the southern African sample is significantly shorter in length than the combined North Atlantic/Mediterranean sample ($U = 203$, $z = 3{,}8$, $\alpha = 0{,}001$) or the Mediterranean sample alone ($U = 31{,}5$, $\alpha = 0{,}05$). The median length of the southern African sample is about 2,75 m, or *c.* 0,5 m less than that of the North Atlantic/Mediterranean sample.

The validity of this conclusion depends on the assumption that animals which have attained their maximum length are adequately represented in the samples. The state of maturity is known for only three specimens in the present material. Two animals, 2,56 m and 2,59 m in length, were physically immature and one, 3,25 m in length, was physically mature. However, as most growth in cetaceans occurs in the first few years of life (Bryden, 1972), those specimens more than 2,75 m in length and with nine or more growth layers in the dentine (Table 68) are considered to be close to or to have reached their maximum length. By comparison two specimens from the North Sea attained physical maturity at lengths of 3,7 m and 3,4 m (Tomilin, 1957).

Total and partial body masses for six *G. griseus* from southern Africa are given in Table 70. The intestine lengths of PEM 1520/75, 2,12 m in length, and PEM 1520/68, 2,45 m in length, were 21,7 m and 25, 6 m respectively.

*Reproduction:* Ovaries from five specimens were examined and data for these are given in Table 63. Four of these females were sexually immature, at total lengths of up to 2,57 m. The fifth animal, PEM 1515/73, had been mutilated before it could be examined. The placenta was found to be intact in the uterus but to be without an attached foetus. It is possible that this female aborted during stranding or that the foetus had been removed after stranding. The corpus

Table 70:

Total mass (kg) and partial body mass, as percentages of total mass, for *Grampus griseus* from the SE coast of southern Africa.

| Catalogue Number | Total length (mm) | Total mass (kg) | Blubber | Meat | Heart Lung and Trachea | Heart | Liver | Spleen | Kidneys |
|---|---|---|---|---|---|---|---|---|---|
| PEM 1519/89 | 840* | 6,67 | — | — | — | — | — | — | — |
| PEM 1520/36 | 1 630 | 38,1 | 21,4 | 22,0 | — | — | — | — | — |
| PEM 1520/75 | 2 120 | 84,8 | 18,5 | 25,2 | 3,4 | 0,66 | 2,8 | 0,066 | 0,88 |
| PEM 1515/04 | 2 425 | 127,0 | 18,9 | 14,2 | — | — | — | — | — |
| PEM 1520/68 | 2 540 | 161,5 | 18,3 | 25,4 | 3,7 | 0,50 | 1,8 | — | 0,90 |
| PEM 1515/78 | 2 560 | 186,0 | 19,0 | 16,8 | 3,0 | 0,76 | 2,0 | 0,029 | — |

* foetus weighed after being frozen for four years.

luteum was situated at one pole of the ovary and consisted of solid luteal tissue. The mammary glands appeared to be inactive when examined macroscopically.

The length of PEM 1515/73 was estimated from the condylobasal length to have been 2,905 m. The only other sexually mature female in the present material was PEM 1513/103, 2,77 m in length. The limited data suggest that sexual maturity probably takes place at about this length.

On limited data Fraser (1974) concluded that the calving season is protracted in *G. griseus*. However, Mizue and Yoshida (1962) concluded from foetal material collected in Japanese waters that the calving period is not protracted and occurs in the summer months. The present material included a 0,56 m foetus (June), a 0,84 m foetus (June/July) which is probably about half-term and a 1,63 m calf (May) possibly one or two months old. If the gestation period of *G. griseus* is about one year as in the similarly-sized *Tursiops truncatus* (Sergeant *et al.*, 1973), the projected birth dates of these three animals would probably have been in the summer months between December and April.

Reproductive data from two males from the SE coast are given in Table 71, with that for three other specimens from the Pacific coast of North America. The limited data suggest that males begin maturing between 2,6 m and 3,0 m in length.

Table 71:

Reproductive data for five male *Grampus griseus* from the SE coast of southern Africa and from the eastern Pacific Ocean.

| Catalogue Number | Total Length (mm) | No. of dentine layers | Size of testis (mm) | | Mass of testis (g) | | | Diamcter of tubules (μ) | Comments Source |
|---|---|---|---|---|---|---|---|---|---|
| | | | left | right | left | right | total | | |
| PEM 1520/36 | 1630 | < 1 | *70 × 10 | 75 × 12 | 4,3 | 5,1 | 8,4 | 22 | Immature. Present study |
| PEM 1515/04 | 2425 | 2+ | *100 × 18 | 105 × 18 | 17 | 16 | 33 | — | Immature. Present study. |
| — | 2580 | 3+ | 120 × 20 | 125 × 20 | 30,4 | 29,2 | 59,6 | — | Stroud, 1968. |
| — | 3070 | — | 500 × 120 | 480 × 110 | — | — | 7012 | 180 | Active. Harrison *et al.*, 1972. |
| — | 3250 | — | 860 × 90 | 910 × 140 | 3130 | 6260 | 9390 | — | Harrison *et al.*, 1972 |

* not sided.

*Food and feeding:* Seven stomachs of *G. griseus* were examined during the study. Four of these were either empty or contained varying amounts of sand. The three remaining stomachs contained cephalopod remains, particularly beaks. The numbers and identifications of the latter are provided in Table 72.

TABLE 72:

Numbers of cephalopod beaks collected from the stomachs of three *Grampus griseus* from the SE coast of southern Africa.

| Cephalopods | PEM 1515/04 | PEM 1518/73 | PEM 1520/75 |
|---|---|---|---|
| HISTIOTEUTHIDAE | | | |
| Type 4 | 1 | | 1 |
| Type 7 | | | 7 |
| Type 8 | | | 2 |
| LYCOTEUTHIDAE | | | |
| *Oregoniateuthis* | 5 | | 130 |
| Type 1 | | | 2 |
| ENOPLOTEUTHIDAE | | | |
| *Ancistrocheirus* | 2 | 1 | 4 |
| OCTOPOTEUTHIDAE | | | |
| *Octopoteuthis* | 2 | 1 | 6 |
| CRANCHIIDAE | | | |
| *Pyrgopsis* | | | 2 |
| CHIROTEUTHIDAE | | | |
| Type 1 | | | 1 |
| Type 2 | | | 4 |
| OMMASTREPHIDAE | | | 2 |
| LOLIGINIDAE | | | |
| *Loligo* | | | 2 |
| SEPIIDAE | | | 7 |
| UNIDENTIFIED | 6 | 1 | 9 |

Cephalopods appear to form the entire diet of this species. Stomachs containing remains of cephalopods have been recorded from stranded or captured animals from British waters (Tomilin, 1959), the Mediterranean (Pilleri and Knuckey, 1969), off Japan (Tsutsumi *et al.*, 1954; Mizue and Yoshida, 1962) and from the eastern Pacific (Orr, 1966; Stroud, 1968). No fish remains have been encountered and Tsutsumi *et al.* (1954) pointed out that *G. griseus* in captivity would only accept squid.

*School size: G. griseus* usually forms small schools but on occasion may form aggregations of up to about 100 animals. The average school size in 40 sightings was 14 animals (data from Table 65; Aguayo, 1975; Fiscus and Niggol, 1965; Pilleri and Knuckey, 1969; Schevill, 1954; Tomilin, 1957; Tsutsumi *et al.*, 1954). Only six of these 40 sightings were of schools of more than 20 animals and one of these consisted of a number of groups of four to six animals totalling over 60 (Schevill, 1954). It is possible that some small groups seen at sea are part of a larger widespread aggregation. Some evidence for this was seen in the successive sightings on 21 January to 31 January 1971 of small groups of *G. griseus* seperated by a few kilometres (Table 65). In Japanese waters schools contain 20 to 30 animals during the summer months but aggregations of up to 200 animals may form in winter, when this species migrates apparently following prey (Mizue and Yoshida, 1962).

*Parasites:* The parasitic cirripede, *Xenobalanus globicipitis*, was recorded on the trailing edge of the flukes of PEM 1520/75, 2,12 m in length, (one specimen) and of PEM 1520/68, 2,54 m in length, (eight specimens). None of these barnacles exceeded 4 mm in length.

A few cestode larvae were found in the blubber of one of three animals examined (PEM

1515/73). A single nematode *Anisakis* (?) *simplex* was collected from the stomach of PEM 1520/75. Lungworms, as yet unidentified, were found in the lungs of PEM 1520/36, 1,63 m in length.

### DISTRIBUTION AND MIGRATION

*G. griseus* occurs in the subtropical to temperate waters of the North Atlantic, Mediterranean and the North and South Pacific Oceans (Tomilin, 1957; Mitchell, 1975). In southern African waters the species occurs from Natal waters to the west coast as far north as Walvis Bay, South West Africa (Barnard, 1954).

On the SE coast of southern Africa *G. griseus* is normally found well-offshore, beyond the 1 000 m isobath (Fig. 35) but to some degree apparently associated with this isobath. Further data are required to confirm this association. Occasionally *G. griseus* may be found in inshore waters. Aguayo (1975) recorded the species three miles off Valparaiso, Chile.

Dated strandings (Table 64) and sight records (Table 65) suggest that *G. griseus* may be found on the SE coast throughout the year. The species may be more common in the second half of the year in eastern Cape waters as 13 out of 17 records for this region are for the months of August to December.

## Genus *TURSIOPS* Gervais, 1855

*Hist. Nat. Mamm.*, 2: 323; type species, *Tursiops tursio* of authors by original designation.

These are medium sized to large dolphins attaining lengths of up to 4 m. The body is relatively robust. The melon is well-formed and tapers anteriorly to a distinct apex. The snout is short (up to 6% body length). The dorsal fin is broad, falcate, erect and of moderate height. The usual colour pattern is dark grey or black dorsally, light grey laterally and whitish ventrally where some spots may be present.

The skull is robust with a rostrum of moderate length (55–60% CBL). The mandibular symphysis is short (12–17% CBL). There are 20 to 29 medium sized teeth in each jaw.

This genus is widely distributed in cool temperate to tropical waters of all seas. A number of species has been described of which the taxonomic status is still in considerable doubt. Some authors (Tomilin, 1957, and others) suggest that there is a single cosmopolitan species, *T. truncatus* Montagu. Others hold that there are two species, *T. gilli* (Dall) and *T. truncatus*, and that the latter possibly includes two subspecies, *T. t. truncatus* and *T. t. aduncus* (Rice and Scheffer, 1968; Hershkovitz, 1966). Van Bree (1966, *in litt.*) suggested that *T. truncatus* and *T. aduncus* (Ehrenberg) are both valid species, each with geographical subspeciation. Pilleri and Gihr (1972a, 1972b, 1973) concluded that *T. truncatus, T. gilli, T. aduncus* and *T. gephyreus* (Lahille) are distinct species.

In southern African waters there occur two distinct forms of *Tursiops*, identified as *T. truncatus* and *T. aduncus* (Ross, 1977). *T. aduncus* inhabits the coastal waters of the SE coast region and *T. truncatus* is found in inshore waters (and possibly offshore) on the west coast of southern Africa, but appears to live predominantly offshore on the south and south-east coasts. The two forms are given full specific status by Ross (1977) on the basis that, although their distributions overlap along the SE coast, there is no evidence that interbreeding occurs. The available evidence suggests that their distributions are essentially allopatric. It is certain to be many years before enough data have accumulated to demonstrate whether this allopatry is the result of competitive exclusion or not. Additional regional studies from all oceans are required to provide morphological, physiological and biochemical characters against which the status of the southern African forms can then be reviewed. For the present, the specific identity of each form has been retained. Serum and haemoglobin samples from west and south-east coast *T. truncatus* and south-east coast *T. aduncus* have been collected and are deep frozen prior to electrophoretic comparisons of their protein components.

The data presented here for these two species have been drawn from a previous study based on 58 specimens from southern Africa (Ross, 1977) and supplemented with information from an additional 37 specimens collected since July, 1975.

### ***Tursiops truncatus*** Montagu, 1821
### Atlantic Ocean Bottlenosed Dolphin

*Tursiops truncatus* Montagu, 1821: 75 (holotype, skull, BM 353h–62.7.18.15; type locality, Duncannon Pool, Devonshire, England); van Bree and Cadenat, 1968: 193; Ross, 1977: 1.
*Tursiops tursio* Sclater, 1901: 212; FitzSimons, 1920: 226.
*Tursiops aduncus* Barnard, 1954: 30 (in part).

#### RECORDS AND MATERIAL

Four specimens of *T. truncatus* from the SE coast of southern Africa were recorded by Ross (1977). One further male animal stranded alive at Uvongo, Natal (30° 50′S 30° 18′E) on 4 November 1976 and was kept at the Durban Dolphinarium until his death on 13 March, 1978, when his total length was 2,78 m (PEM 1521/10). The distribution of six offshore sightings of *Tursiops* sp. reported previously (Gambell *et al.*, 1975; Ross, 1977) and the localities of stranded *T. truncatus* are mapped in Fig. 36. The position of a school of 80 to 100 dolphins identified from an excellent photograph in the PEM files as *T. truncatus* has also been mapped. This school was sighted 25,5 km off Green Point, Natal (30° 17′S, 31° 07′E) on 24 February 1976.

#### SPECIFIC STATUS AND CHARACTERS

Southern African specimens of *Tursiops* identified by comparison with nominate *T. truncatus* from British waters as *T. truncatus* (Ross, 1977) may be distinguished from *T. aduncus* on several features. These features are listed and compared in Table 74 for 10 southern African *T. truncatus* and 42 *T. aduncus*.

#### DESCRIPTION

An immature male (SAM 36847), 2,255 m in length, is illustrated in Fig. 21. This specimen was collected over the Walter Shoal, south of Madagascar (33° 19′S, 45° 51′E) (Gambell *et al.*, 1975).

The body is robust, rounded in transverse section anteriorly and becomes increasingly compressed laterally towards the flukes. The melon is distinct, subspherical and slightly depressed dorsally. It extends beyond the jaws laterally and in profile slopes evenly to a distinct

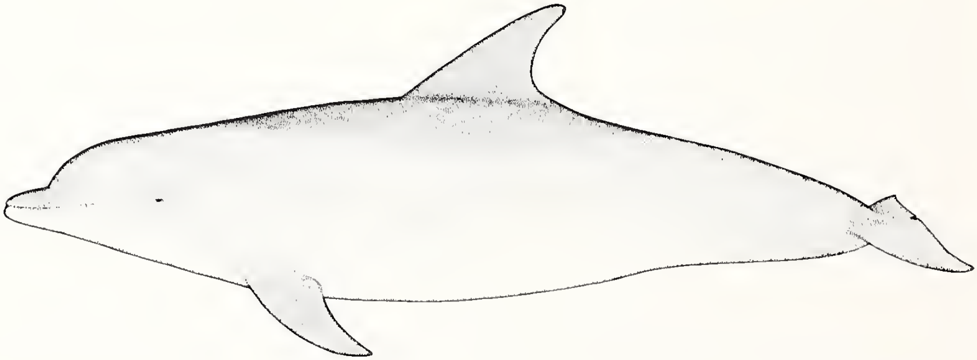


Fig. 21. Immature male *Tursiops truncatus*, 2,25 m in length, from the SW Indian Ocean (SAM 36847).

apex. The snout is short (3–5% of total length) and robust. The line of the gape is almost straight and is inclined dorsally towards the eye, except the most proximal part which is curved ventrally. The dorsal fin is triangular, of moderate height (8–10% of total length), falcate, has a curved leading edge and is broad at its base (15–19% of total length); it is set at approximately midlength of the body. The flipper is broad basally and tapers to a rounded apex. It is of moderate length (15–16% of total length), has a strongly convex leading edge, and a concave trailing edge distally. The flukes are broad and full and have a well defined caudal notch.

The colouration of three specimens of southern African *T. truncatus* was recorded while the animals were alive or by photography shortly after death. The colour pattern is comprised of a dark grey dorsal cape system and a lighter grey dorsal field overlay (terminology of Perrin, 1972). The dorsal cape system includes the upper surface of the beak, the anterior part of the lower jaw, the bridle from the eye and from the blowhole to the apex of the melon. The cape itself broadens posteriorly to a maximum at the level of the anterior insertion of the dorsal fin and terminates mid-dorsally posterior to the fin, and the flukes and dorsal fin.

The paler grey dorsal field overlay extends over the lateral surfaces of the body to approximately mid-depth of the body. Posterior to the anal opening it meets in the ventral midline and covers the entire caudal peduncle. A broad dark flipper stripe runs from the eye to the insertion of the flipper, and thence over both surfaces of the flipper. The stripe is demarcated dorsally by a thin white or pale grey line.

The ventral surface is off-white or very pale grey in colour. Dark spots on the ventral surface as found in some *T. aduncus* and some old femlaes of North Atlantic *T. truncatus* (Leatherwood *et al.*, 1976) have not been observed in southern African specimens.

The skull is robust and has a broad, evenly tapered rostrum which is 55–59% of CBL in length. The premaxillae on the rostrum are not strongly convex in anterior view. The lateral margins of the orbits are sub-parallel. In lateral view the jugal is thin and elongated (9–13% CBL in length). There are 22–25 teeth in each upper jaw and 21–23 (rarely 24) teeth in each lower jaw. Additional cranial features are listed in Table 74. Skull measurements of PEM 1521/10 are provided in Table 76.

The vertebral formulae in three southern African specimens were C7 T12 L + Cd42(+4) = 65; C7 T12 L + Cd39(+6) = 64; C7 T13 L + Cd45 = 65 (Ross, 1977). The formula of PEM 1521/10 was C7 T13 L17 Cd27 = 64. The vertebral formula of North Atlantic *T. truncatus* is similar; C7 T12–14 L17 Cd26–27 = 63–64 (Tomilin, 1957). The arterial canal through the transverse process of the vertebrae first appeared in vertebra number 45 in PEM 1521/10.

## BIOLOGY

*Age determination:* Counts of dentine growth layers in longitudinal thin sections of teeth from seven southern African *T. truncatus* including four from the SE coast have been reported previously (Ross, 1977). The formation of secondary dentine precluded counts after more than about 9–11 layers had been deposited.

Six complete growth layers and one incomplete growth layer were counted in the tooth of the 2,78 m male, PEM 1521/10. The incomplete inner layer was opaque. The pulp cavity was open for 70% of the length of the tooth.

The rate of layer formation in southern African *T. truncatus* has not been determined. However, it is likely to be similar to that in western North Atlantic specimens in which one growth layer is deposted per year (Sergeant *et al.*, 1973).

*Growth and development:* The length at birth in southern African specimens is unknown. North Atlantic animals are born at 0,98 to 1,26 m in length (Harrison *et al.*, 1969).

The longest record *T. truncatus* from the SE coast was a 3,27 m male, PEM 1515/94. Other specimens between 2,6 m and 2,8 m were sexually immature or maturing. There is some evidence that *T. truncatus* off the South West African coast may attain lengths of up to 3,6 m.

Two dolphins now in the Durban Dolphinarium, from this region measured 2,80 m and 2,96 m at capture. They had been selected from a school netted from the beach and which contained animals up to 0,6 m greater in length than those caught. In British waters *T. truncatus* reaches a maximum length of about 4 m and a modal length of between 3,2 m and 3,6 m (Fraser, 1974). Similarly West African *T. truncatus* may attain lengths of 3,68 m (Cadenat, 1958). However, specimens of *T. truncatus* from Florida are considerably smaller and males and females examined attained asymptotic lengths of about 2,7 m and 2,5 m respectively (Sergeant *et al.*, 1973).

A total mass of 234 kg was recorded for a slightly emaciated male at the time of his death under anaesthesia. Total and partial body masses were reported for two other *T. truncatus* from the SE coast by Ross (1977).

*Reproduction:* There are very few data concerning the reproduction of *T. truncatus* in southern African waters.

The only southern African female, PEM 1515/74, examined was sexually immature at a length of 2,795 m.

Details of the testes of PEM 1521/10 are provided in Table 80. This specimen was sexually immature. A second male, 2,605 m in length, was also immature and a 2,72 m long male was considered to be maturing but not fully sexually active (Ross, 1977).

*Food and feeding:* The contents of two stomachs have been described previously (Ross, 1977). In that paper the cephalopod beaks found in both stomachs were erroneously identified as those of enoploteuthid squids but are now known to be those of the lycoteuthid squid referred to as *Oregoniateuthis* in this report. Otoliths from one *Merluccius* and six *Lepidopus caudatus* were also found in one stomach. This suggested that on the SE Coast *T. truncatus* may feed further offshore than does *T. aduncus.* However, on the west coast *T. truncatus* may be found close to the breaker zone.

There are several accounts of and reviews concerning the types of food eaten by *T. truncatus* in the North Atlantic and the Black Sea and by *Tursiops* cf. *gilli* in the North Pacific (Leatherwood, 1975 and references therein; Tomilin, 1957). All refer to dolphins feeding on a wide variety of fish, particularly benthic forms, squid and crustaceans in coastal or shallow water habitats. Tomilin (1957) noted that *T. truncatus* in the Black Sea feed on pelagic fish only if the latter form dense shoals. The diet of coastal *T. truncatus* elsewhere is similar to that of *T. aduncus* on the SE coast of southern Africa.

The stomach contents of a 2,50 m long female *T. truncatus* captured in deeper waters off Senegal and described by Cadenat (1959) included bathypelagic crustaceans, cephalopod beaks and fragments, two *Gempylus serpens* and remains of several macrourids which suggests that this animal had been feeding over deep water in excess of 200 m and possibly at a considerable depth. Rancurel (1964, *in* Purves and van Bree, 1972) collected bathypelagic fish from the stomach of a specimen collected off the Ivory Coast and showed that this animal had reached a depth of at least 500 m and possibly the sea bed at 800 m depth.

*School size:* There are few records of school size for *Tursiops* sp. sighted in water deeper than 200 m. Taruski and Winn (1976) saw four schools containing ten, several, three and three individuals in the West Indies. Off the SE coast of southern Africa eight schools of *Tursiops* sp. contained from three to about 100 animals, with a mean of about 22. Only one of these groups consisted of more than about 30 individuals.

*T. truncatus* forms relatively small schools in coastal waters of the Atlantic. The mean school size of 18 groups sighted off Florida (Leatherwood, 1975), West Africa (Cadenat 1958), in the West Indies (Taruski and Winn, 1976) and in the Mediterranean (Pilleri and Knuckey, 1969) was 15 (range 2–*c.*100). Only one of these contained more than 40 animals and it was comprised of several smaller groups. Aerial surveys by Odell (1976) of the Everglades National Park and Biscayne Bay in Florida provided mean school sizes of 2,95 (range 1–25, n = 385 sightings) and 8 (range 3–13, n = 6 sightings) respectively. Würsig and Würsig (1977) studied a group of *Tursiops* on the coast of Argentina which varied in number from eight to 22, with a mean group size of 15. On the Atlantic coast of the United States migrating *T. truncatus* may form large schools of up to 600 animals. In general these schools are smaller than those formed by the coastal *T. aduncus* in southern African waters, as described under that species.

### Distribution and migration

Owing to the confused taxonomic state of the genus the distribution of *T. truncatus (sensu stricto)* is not clear. The nominate form is widely distributed on the coasts of the North Atlantic, the Mediterranean and the Black Sea, West Africa, Gulf of Mexico and the Caribbean (Tomilin, 1957; Leatherwood *et al.*, 1976). In the South Atlantic *T. truncatus* is recorded from St. Helena (Pilleri and Gihr, 1973/74); specimens from Uruguay may or may not belong to a distinct species, *T. gephyreus* (Pilleri and Gihr, 1972b).

*Tursiops* from South Australia have been classified as *T. truncatus* by Harrison and Fanning, 1973/74 though dental formulae given by these authors for several specimens, which have 20 to 26 teeth in each jaw, range more widely than would be expected in nominate *T. truncatus*. Specimens of *Tursiops* which appear to be identical with *T. truncatus* from the North Atlantic have been recorded in New Zealand waters (Gaskin, 1968a).

In southern African waters *T. truncatus* has been recorded on the west coast as far north as Cape Cross (21° 56′S, 13° 55′E). On the south and SE coasts the species is recorded in water of more than 200 m depth. This offshore distribution is based only on identifications of schools at sea from photographs or specimens, and the presence of beaks of the squid *Oregoniateuthis* in the stomachs of both of the stranded animals examined to date. Preliminary analysis of tunny stomachs containing undigested *Oregoniateuthis* suggests that this squid inhabits waters over or adjacent to the continental slope perhaps in association with the strong thermal gradients found on the inner edge of the Agulhas Current (Ross 1979).

There is no information on the seasonal occurrence of *T. truncatus* off the SE coast of southern Africa. The dates of strandings and that of one identified sighting at sea cover much of the year (eastern Cape-April and October; Natal-February, August and November) and do not suggest that the species occurs seasonally in this area.

## ***Tursiops aduncus*** (Ehrenberg, 1832)
## Indian Ocean Bottlenosed Dolphin

*Delphinus aduncus* Ehrenberg, 1832: footnote 1 (type, non-existent, description based on stranded animal; type locality, Belhosse Island, Red Sea).
*Tursiops tursio* Sclater, 1901: 212 (in part).
*Tursiops catalania* True, 1914: 10; Roberts, 1951: 231.
*Steno rostratus* Weber, 1923: 1 (misidentification).
*Tursiops catalaniae* Barnard, 1924: 1.
*Tursiops aduncus* Ellerman, Morrison-Scott and Hayman, 1953: 330; Barnard, 1954: 30 (in part); van Bree, 1966: 425; Best, 1971: 7; Pilleri and Gihr, 1972a: 107; Saayman, Bower and Tayler, 1972: 1; Tayler and Saayman, 1972: 11; Saayman and Tayler, 1973: 993; Saayman, Tayler and Bower, 1973: 212; Tayler and Saayman, 1973: 286; Ross, 1977: 1.

### Records and material

This species is the most commonly stranded and sighted cetacean on the SE coast of southern Africa. Skeletal material from six specimens collected at Mossel Bay and Durban has been described by van Bree (1966) and True (1914) respectively. Subsequently, material has been listed and described by Ross (1977). An additional 36 animals have been examined since July 1975; details of their provenance are provided in Table 73.

TABLE 73:

Records of *Tursiops aduncus* collected on the SE coast of southern Africa since July 1975.

| Catalogue Number | Sex | Total length (mm) | CBL (mm) | Date | Locality | Comments |
|---|---|---|---|---|---|---|
| PEM 1519/75 | ♂ | 2 380 | — | 16.09.75 | North Coast Natal | Stranded. |
| PEM 1519/76 | ♂ | 2 400 | 486 | — | Natal Coast | Stranded? |
| PEM 1519/77 | ♂ | (2 430) | 452 | 13.07.75 | Salt Rock | Shark nets. |
| PEM 1519/79 | — | — | 473 | — | Natal Coast | Head only. Shark nets. |
| PEM 1519/80 | ♂ | 1 790 | — | — | Natal Coast | Marks on body suggest capture by shark nets. |
| PEM 1519/82 | ♂ | 2 410 | 460 | July 1975 | Scottborough | Shark nets. Physically mature. |
| PEM 1519/86 | ♀ | 1 600 | — | 23.10.75 | Umhloti | Stranded. |
| PEM 1519/87 | ♀ | 2 200 | 463 | 04.11.75 | Cape Receife | Stranded. |
| PEM 1519/88 | ♂ | 880 | — | 10.11.75 | P.E. Oceanarium | Born in captivity. |
| PEM 1519/99 | ♂ | — | 470 | 27.02.76 | P.E. Oceanarium | Captured 09.12.71 at Port Elizabeth. |
| PEM 1520/00 | — | 2 050 | — | 05.03.76 | 8 km E of Sundays River Mouth | Decomposing carcase. Physically mature. |
| PEM 1520/09 | — | — | 492 | 23.05.76 | Seaview | Rotten carcase. |
| PEM 1520/11 | ♀ | 1 780 | — | 11.07.76 | 8 km W of Sundays River Mouth | Emaciated. Trapped by a loop of fishing nylon. |
| PEM 1520/18 | ♀ | 2 135 | — | 10.05.76 | 5 km off Umhlanga Rocks | Died during capture. |
| PEM 1520/19 | ♂ | 2 300 | — | 05.07.76 | 7 km off Durban | Died in captivity 19.08.76. |
| PEM 1520/24 | ♀ | (2 380) | — | 28.10.76 | 2 km W of Sundays River Mouth | Decomposing carcase. |
| PEM 1520/28 | ♀ | 950 | — | 14.11.76 | P.E. Oceanarium | Born in captivity. |
| PEM 1520/34 | ♂ | 2 330 | — | 1976 | Natal Coast | — |
| PEM 1520/35 | ♀ | 1 340 | — | 1976 | Natal Coast | Umbilicus healed. Teeth unerupted. |
| PEM 1520/37 | ♀ | 2 120 | — | mid June 1976 | 4 km off Durban | Died in captivity 18.08.76. |
| PEM 1520/48 | ♀ | 2 480 | 499 | April 1977 | Schoenmakerskop | Decomposing carcase. Physically mature. |
| PEM 1520/50 | — | — | 507 | April 1977 | Port Elizabeth | Skull found on building site. |
| PEM 1520/62 | ♂ | 1 975 | 449 | 12.05.77 | Knoetzie | Stranded alive. |
| PEM 1520/77 | ♂ | 1 290 | — | 1977 | Natal Coast | Neonate. Umbilicus not completely healed. |
| PEM 1520/78 | ♂ | 1 340 | — | 12.09.77 | St. Michael's On Sea | Shark nets. |
| PEM 1520/79 | ♀ | 1 420 | — | 1977 | Natal Coast | Stranded. Decomposing. |
| PEM 1520/80 | ♀ | 1 420 | — | 08.06.77 | Amanzimtoti | Shark nets. |
| PEM 1520/81 | ♂ | 1 720 | — | 1977 | Natal Coast | Shark nets? |
| PEM 1520/82 | ♂ | 2 330 | — | 23.09.77 | Amanzimtoti | Shark nets. Physically mature. |
| PEM 1520/83 | ♂ | 2 350 | — | — | Natal Coast | Shark nets. Physically mature. |
| PEM 1520/88 | ♂ | 2 350 | — | 08.11.77 | Sundays River Mouth | Stranded. |
| PEM 1520/91 | ♂ | 1 040 | — | 14.12.77 | Eerste Rivier, E. Cape | Neonate. Stranded alive. Umbilicus not healed. |
| PEM 1521/00 | ♀ | 1 045 | — | 07.03.78 | Riet Point, Port Alfred | Neonate. Umbilicus not healed. |
| PEM 1521/13 | — | — | — | Feb. 1978 | Sundays River Beach | Clean skull found on beach. |
| PEM 1521/16 | ♂ | 2 340 | — | 28.04.78 | 2 km W of Woody Cape | Decomposing carcase. |
| PEM 1521/17 | ♂ | 1 060 | — | 28.04.78 | Woody Cape | Fresh neonate. |

### SPECIFIC STATUS AND CHARACTERS

The confusion over the specific status of *T. aduncus* has been mentioned briefly in the generic description. It has arisen from different interpretations by a number of authors of the taxonomic status of a number of *Tursiops* populations. The interpretations were based on very small samples and all authors agreed that larger regional series of specimens were necessary before an adequate taxonomic assessment could be made. Recently series of specimens from Pakistan, south-west Asia and southern Africa have been studied by Pilleri and Gihr (1972a, 1973/74) and Ross (1973, 1977) who concluded that *T. aduncus* was a distinct form and in their opinion a valid species distinguishable from *T. truncatus* on a number of external and skeletal features (Table 74). The validity of this conclusion can only be judged when more detailed

TABLE 74:
Comparison of features which distinguish *Tursiops truncatus* (n = 10) and *Tursiops aduncus* (n = 42) in southern African waters. Data taken from the present study and Ross (1977).

| Features | *T. aduncus* | *T. truncatus* | t-values |
|---|---|---|---|
| Total length | Up to 2,6 m | Up to 3,3 m | |
| Beak length (% TL) | x̄ = 5,2 (4,4–6,0); n = 30 | x̄ = 3,8 (3,1–4,7); n = 6* | 7,10 |
| Condylobasal length (mm) | x̄ = 473 (433–507); n = 34 | x̄ = 547 (504–578); n = 8 | 8,749 |
| Rostrum, basal width (% CBL) | x̄ = 23,8 (21,4–27,7); n = 34 | x̄ = 26,1 (24,5–27,3); n = 8 | 5,028 |
| Rostrum, width 60 mm anterior to antorbital notches (% CBL) | x̄ = 16,9 (15,9–19,2); n = 34 | x̄ = 20,5 (18,3–22,5); n = 8 | 6,068 |
| Rostrum, width at midlength (% CBL) | x̄ = 13,8 (11,6–16,5); n = 33 | x̄ = 16,1 (14,5–18,3); n = 8 | 5,6815 |
| Premaxillae, width at midlength of rostrum (% CBL) | x̄ = 7,3 (6,4–9,9); n = 34 | x̄ = 8,9 (7,5–9,9); n = 8 | 5,609 |
| Preorbital width (% CBL) | x̄ = 43,0 (41,0–46,2); n = 33 | x̄ = 46,3 (43,2–48,4); n = 8 | 5,820 |
| Orbital width (% CBL) | x̄ = 43,3 (42,2–47,3); n = 33 | x̄ = 46,1 (44,2–47,6); n = 5 | 5,594 |
| Number of mandibular teeth | x̄ = 26,1 (23–29); n = 31 | x̄ = 22,4 (21–24); n = 8 | 10,663 |
| Posterior portion of vomer | Narrow, parallel or sub-parallel margins | Wide, flaring posteriorly | |
| Pterygoid notch | Narrow; sub-acute apex | Broad; obtuse apex | |
| Squamosal in wall of temporal fossa | Small; dorsally-directed apex | More extensive; apex directed postero-dorsally | |
| Convexity of premaxillae in middle third of rostrum, in anterior view | Strongly convex | Not strongly convex | |
| Width of cancellous bone on lateral border of premaxillae in middle third of rostrum | Absent or very narrow | Broad, more than 3 mm | |
| Vertebral count | 57–63 | 64–65 | |

* includes beak measurements of two animals captured at Walvis Bay, and now at Durban Dolphinarium (3,8%, 4,3% TL).

studies have been made of other populations of *Tursiops*, particularly those in the North and South Pacific regions and the western South Atlantic, allowing the problem to be viewed on a global basis. In the interim, the retention of the specific status of *T. aduncus* will provide a baseline for further comparisons which would not be available should these populations be merely classified as *Tursiops* spp. or *Tursiops truncatus*. The use of the trinomial *T. truncatus aduncus* represents a compromise between these alternatives and full specific status but is suggestive of a far better understanding of the problem than is really true.

In Table 74 distinguishing measurements and features of 10 *T. truncatus* and 42 *T. aduncus* have been presented. Statistical comparison of the measurements using Student's *t*-test showed that they differed significantly ($\alpha = 0{,}002$, in a two sided test) though the ranges of values overlapped quite considerably in some instances. Only minor differences were found in a comparison of the Pakistan and south-west Asian skull measurements (Pilleri and Gihr, 1973/74) with those from southern Africa (Ross, 1977). These may be accounted for in part by slightly different measuring techniques and by the smallness of sample sizes in the former series.

## DESCRIPTION

A 2,35 m subadult male, PEM 1520/88, is illustrated in Fig. 22.

Externally *T. aduncus* resembles *T. truncatus*, in the relative robustness of the body and the form of the appendages. The melon, however, is less convex in profile and its apex is situated more posteriorly on the beak. The snout is proportionately longer and narrower than that of *T. truncatus* and gives this species a more slender appearance in profile.

External measurements of 22 *T. aduncus* from southern Africa collected since 1975 are provided in Table 75.

The basic colour pattern of *T. aduncus* from southern Africa is essentially the same as that described for *T. truncatus* and consists of a dark grey to greyish black dorsal cape system, a paler grey dorsal field overlay and an off-white to pinkish ventral surface, as shown in Fig. 22. There is some variation on this basic pattern in southern African specimens, in which the ventral surface of the throat may be pale grey, a grey mid-abdominal streak may be present and light grey or dark spots may be scattered over the anterior or entire ventral surface. Perrin (1972) suggested that such variations may be due to differences in the extent of the dorsal field overlay.

The presence or absence of ventral spots was recorded for 32 specimens. Spots were absent in all 14 animals known to be sexually immature at lengths of up to 2,35 m. Ventral spots

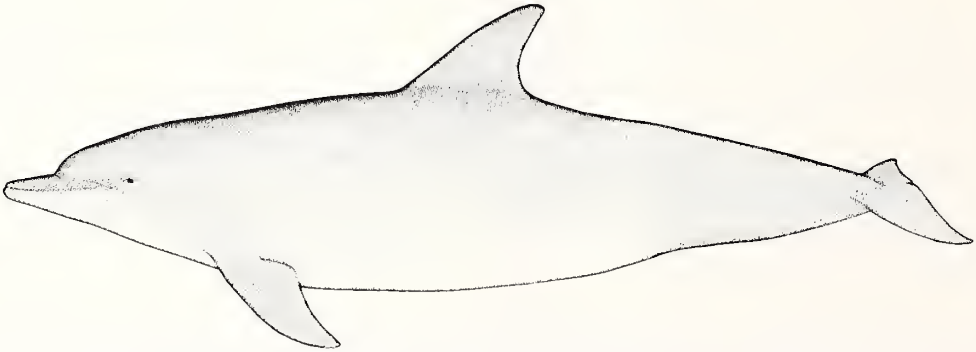


Fig. 22. Subadult male *Tursiops aduncus*, 2,35 m in length, from the eastern Cape (PEM 1520/88).

were present on a 2,12 m long female of unknown age and eight (six males, two females) sexually mature animals from Natal waters. In these specimens the spots were large, dark and distributed over the entire ventral surface except for a narrow strip, enclosing the genital and anal apertures. Eastern Cape animals do not develop the same intensity of spotting as those from Natal. No spots were noted on six (three males, three females) sexually mature dolphins from eastern Cape waters. In two males and one female ventral spots were present but were confined to the area anterior to the umbilicus; two of these animals were captured from the same school. Only one dolphin, a physically mature female, PEM 1517/60, had large dark spots over the entire ventral surface. Though further material is required, the difference in the degree of spotting in these specimens may indicate that the populations of *T. aduncus* in eastern Cape and Natal waters are discrete.

The skull of *T. aduncus* is robust and has a rostrum of moderate length (54–60% CBL). The lateral margins of the proximal 60 mm of the rostrum taper abruptly and the premaxillae are strongly convex transversely on the dorsal surface of the rostrum. The lateral margins of the orbit are inclined anteromesially in dorsal view and in anterior view the supraorbital plate appears robust, owing to the large maxillary prominence. The jugal is shorter (7,3–11,0% CBL) and thicker than in southern African *T. truncatus*.

Skull measurements for 10 *T. aduncus* are provided in Table 76. A comparison of skull measurements of 25 eastern Cape (CBL 430–507 mm; $\bar{x}$ = 471 mm) and 13 Natal (CBL 431–489 mm; $\bar{x}$ = 465 mm) specimens (present study; Ross, 1977) showed a significant difference (t = 6,23; df 32) in the condylar height of the mandible (meas. no. 29) between the two samples:

Eastern Cape — $\bar{x}$ = 17,89% CBL, SD = 0,58, n = 23;
Natal — $\bar{x}$ = 17,13% CBL, SD = 0,56, n = 11.

This difference, though small, supports the suggestion based on colour patterns that the Natal and eastern Cape populations are separate entities.

The usual vertebral formula in 23 specimens examined from the SE coast was C7 T12–13 L14–15 Cd25–27 = 59–62 and the range of variation was C7 T12–14 L13–18 Cd22–27 = 57–63. The high counts of lumbar vertebrae were made in neonatal or very young animals and presumably reflect a lack of ossification in the most anterior chevron bones. The mean number of vertebrae in 34 specimens was 60,2. There was no significant difference in the vertebral counts of eastern Cape specimens ($\bar{x}$ = 60,0; n = 16) and those from Natal ($\bar{x}$ = 60,4; n = 18).

The arterial canal through the transverse process first appeared in vertebra no. 39 in PEM 1520/82 and PEM 1520/37, and in no. 38 (vertebrae nos 38–57 only were collected) in PEM 1520/83.

The neural spine of the atlas in PEM 1520/62 was short and truncated and partially bifid terminally. In two uncatalogued specimens of *T. aduncus* from the SE coast this spine was short or of moderate length and partially bifid terminally in each case.

## BIOLOGY

*Age determination:* Teeth from 17 specimens in the new material were examined, as thin longitudinal sections, under transmitted light. Counts of growth layers and other comments are provided in Table 77. The formation of poorly laminated secondary dentine and the subsequent closing of the pulp cavity limited counts of growth layers, as described in a previous study (Ross, 1977).

The rate of formation of growth layers in the dentine was estimated indirectly from the teeth of a female, PEM 1516/00, which had been captured as a young animal of unknown age and held in captivity for eight years. At death 13 growth layers were counted in the dentine, indicating that the accumulation rate is less than two layers per year and probably one layer per

TABLE 75:

External measurements in mm of 22 *T. aduncus* from the SE coast of southern Africa. Measurement numbers are keyed to Table 2.

| Meas. No. | PEM 1520/28 ♀ | PEM 1520/91 ♂ | PEM 1521/00 ♀ | PEM 1520/77 ♂ | PEM 1520/35 ♀ | PEM 1520/78 ♂ | PEM 1520/79 ♀ | PEM 1520/80 ♀ | PEM 1519/86 ♀ | PEM 1520/81 ♂ | PEM 1520/11 ♀ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 950 | 1 040 | 1 045 | 1 290 | 1 340 | 1 340 | 1 420 | 1 420 | 1 600 | 1 720 | 1 780 |
| 2 | 180 | 190 | 210 | 190 | 220 | 225 | 220 | 240 | 240 | 290 | 300 |
| 3 | 63 | 65 | 68 | 60 | 60 | 70 | 90 | 75 | 80 | 100 | 110 |
| 4 | 150 | 160 | 175 | 155 | 175 | 180 | 180 | 195 | 200 | 240 | 245 |
| 5 | 223 | 230 | 255 | — | — | 270 | — | — | — | 360 | — |
| 6 | 43 | 45 | 45 | — | — | 50 | — | — | — | 65 | — |
| 7 | 35 | 40 | 40 | 50 | 45 | 50 | 60 | 45 | — | 55 | 60 |
| 8 | 205 | 115 | 120 | 145 | 140 | 140 | 155 | 140 | — | 170 | 185 |
| 9 | 175 | 190 | 205 | 190 | 200 | 220 | 240 | 235 | 250 | 290 | 300 |
| 10 | 265 | 295 | 320 | 310 | 350 | 350 | 310 | 350 | 380 | 400 | 450 |
| 11 | 480 | 500 | 560 | 610 | 640 | 650 | 660 | 650 | 720 | 760 | 810 |
| 12 | 650 | 680 | 720 | 760 | 830 | 830 | 880 | 850 | 930 | 1 030 | 1 060 |
| 13 | 480 | 510 | 570 | 630 | 660 | 650 | 690 | 680 | — | — | — |
| 14 | 640 | 630 | 750 | 800 | 900 | 820 | 960 | 990 | 1 100 | 1 060 | 1 230 |
| 15 | 670 | 715 | 785 | 920 | — | 950 | 1 000 | 1 030 | — | 1 210 | — |
| 16 | — | 3 | 5 | 5 | — | — | 10 | 7 | 12 | 10 | — |
| 20 | 450 | 520 | 570 | 720 | — | 740 | — | 800 | — | 900 | — |
| 21 | 490* | 580** | 560 | 800** | — | 810* | — | 840 | — | 980* | — |
| 22 | 280 | 320 | 310 | 430 | 430 | 440 | — | 470 | 500 | 550 | — |
| 23 | 14 | 20 | 20 | 20 | — | 20 | — | 20 | — | 25 | 28 |
| 24a | 7 | — | — | — | — | — | — | — | — | — | 15 |
| b | 6 | — | 7 | — | — | — | — | — | — | — | 15 |
| 25a | — | 40 | — | 60 | — | 60 | — | 65 | — | 100 | — |
| b | — | 8 | — | 8 | — | 12 | — | 5 | — | 20 | — |
| c | 48 | — | 70 | — | — | — | 80 | — | — | — | 120 |
| 26 | 20 | 18 | 25 | 22 | — | 25 | 25 | 25 | — | 28 | 25 |
| 27 | 195 | 230 | 245 | 240 | 230 | 250 | 240 | 260 | 260 | 300 | 285 |
| 28 | 135 | 160 | 170 | 170 | 170 | 175 | 170 | 180 | 180 | 205 | 205 |
| 29 | 68 | 80 | 78 | 83 | 88 | 82 | 87 | 86 | 80 | 108 | 100 |
| 30 | 110 | 100 | 112 | 122 | 110 | 130 | 135 | 122 | 150 | 155 | 140 |
| 31 | 150 | 170 | 170 | 185 | 180 | 200 | 240 | 210 | 220 | 260 | 280 |
| 32 | 170 | 220 | 215 | 260 | 280 | 300 | (320) | 290 | — | 355 | 320 |
| 33 | 85 | 95 | 95 | 100 | 110 | 110 | 105 | 113 | 110 | 120 | 125 |
| 34 | 20 | 20 | 20 | 25 | 25 | 30 | — | 22 | — | 25 | 20 |

| Meas. No. | PEM 1519/80 ♂ | PEM 1520/37 ♀ | PEM 1519/87 ♀ | PEM 1520/19 ♂ | PEM 1520/82 ♂ | PEM 1520/83 ♂ | PEM 1520/88 ♂ | PEM 1519/76 ♂ | PEM 1519/82 ♂ | PEM 1519/77 ♂ | PEM 1520/48 ♀ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 790 | 2 120 | 2 200 | 2 300 | 2 330 | 2 350 | 2 350 | 2 400 | 2 410 | (2 430) | 2 480 |
| 2 | 280 | 340 | 320 | 340 | — | 320 | 320 | 330 | 310 | 320 | 335 |
| 3 | 90 | 125 | 1 250 | 120 | 110 | 120 | 120 | 123 | 115 | 108 | 123 |
| 4 | 240 | 280 | 260 | 280 | — | 270 | 270 | 280 | 215 | 260 | 260 |
| 5 | — | — | — | 405 | — | 390 | — | — | 370 | — | — |
| 6 | — | — | — | 70 | — | 75 | — | — | 750 | — | — |
| 7 | 60 | 60 | 65 | 60 | — | 65 | 70 | 60 | 60 | 60 | — |
| 8 | 190 | 210 | 190 | 200 | — | 200 | 230 | 200 | 190 | 190 | — |
| 9 | 290 | 340 | 340 | 350 | — | 320 | 320 | 340 | 330 | 320 | 360 |
| 10 | 450 | 530 | 510 | 530 | — | 510 | 510 | 530 | — | 510 | 560 |
| 11 | 840 | 880 | 990 | 1 010 | — | 1 020 | 990 | 1 070 | 1 020 | — | 1 010 |
| 12 | 1 120 | 1 120 | 1 320 | — | — | 1 450 | 1 370 | 1 470 | 1 350 | — | (1 480) |
| 13 | — | — | — | — | — | 910 | 1 100 | 1 140 | — | — | — |
| 14 | 1 100 | — | 1 500 | 1 650 | — | 1 390 | 1 450 | 1 500 | 1 420 | — | 1 680 |
| 15 | 1 280 | — | 1 560 | — | — | 1 660 | 1 650 | 1 740 | 1 690 | — | — |
| 16 | 10 | — | 12 | — | — | 20 | 5 | 20 | 15 | 10 | — |
| 20 | — | — | 1 120 | — | — | 1 300 | — | — | — | — | — |
| 21 | — | — | 1 180 | — | — | 1 480* | — | — | — | — | — |
| 22 | 560 | — | 700 | — | — | 840 | 790 | 840 | 920 | 950 | — |
| 23 | — | — | — | — | — | 26 | — | — | 33 | — | — |
| 24a | — | — | 8 | — | — | — | — | — | — | — | — |
| b | — | — | 10 | — | — | — | — | — | — | — | — |
| 25a | 90 | — | — | — | — | 160 | 170 | 190 | 140 | 150 | — |
| b | 15 | — | — | — | — | 50 | 20 | 70 | — | 30 | — |
| c | — | — | 155 | — | — | — | — | — | — | — | — |
| 26 | — | — | 28 | — | — | 35 | 35 | — | 28 | — | — |
| 27 | 300 | 360 | 380 | 380 | 390 | 420 | 430 | 430 | 400 | 390 | 400 |
| 28 | 210 | 240 | 260 | 260 | 300 | 305 | 300 | 310 | 300 | 300 | 275 |
| 29 | 105 | 125 | 140 | 140 | 154 | 160 | 157 | 155 | 150 | 160 | — |
| 30 | 150 | 250 | 220 | — | 250 | 300 | 260 | 265 | 260 | 250 | (290) |
| 31 | 230 | 340 | 350 | 360 | 340 | 400 | 350 | 400 | 450 | 360 | (450) |
| 32 | 380 | 480 | 430 | 540 | 640 | 660 | 580 | 590 | 580 | 580 | — |
| 33 | 150 | 155 | 280 | 160 | 175 | 201 | 180 | 190 | 170 | 180 | — |
| 34 | 20 | 40 | 30 | 30 | 30 | 55 | 30 | 35 | 25 | 35 | — |

* Measured at anterior insertion of dorsal fin.

** Measured at umbilicus.

( ) denotes approximate measurement.

Nos. 18 a, b, c, Blubber thickness for PEM 1520/91 were each 15 mm.

TABLE 76:

Skull measurements in mm of one *Tursiops truncatus* and 10 *T. aduncus* from the SE coast of southern Africa. Measurement nos. are keyed to Table 6.

| Meas. No. | *T. truncatus* | *T. aduncus* | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | PEM 1521/10 | PEM 1520/62 | PEM 1519/77 | PEM 1519/82 | PEM 1519/87 | PEM 1519/99 | PEM 1519/79 | PEM 1519/76 | PEM 1520/09 | PEM 1520/48 | PEM 1520/50 |
| 1 | 538 | 449 | 452 | 460 | 463 | 470 | 473 | 486 | 492 | 499 | 507 |
| 2 | 299 | 257 | 262 | 262 | 268 | 269 | 276 | 281 | 292 | 285 | 297 |
| 3 | 142 | 106 | 125 | 113 | 104 | 111 | 114 | 121 | 111 | 118 | 119 |
| 4 | 115 | 77 | 84 | 75 | 76 | 76 | 80 | 82 | 77 | 87 | 88 |
| 5 | 90 | 65 | 63 | 63 | 64 | 60 | 64 | 65 | 64 | 71 | — |
| 6 | 48 | 34 | 33 | 32 | 46 | 30 | 34 | 33 | 33 | 32 | 35 |
| 7 | 354 | 298 | 300 | 308 | 315 | 308 | 318 | 324 | 337 | 337 | 343 |
| 8 | 366 | 295 | 298 | — | — | 308 | 312 | — | 333 | 331 | 338 |
| 9 | 255 | 192 | 209 | 196 | 208 | 197 | 203 | 212 | 205 | 217 | 213 |
| 10 | 279 | 221 | 233 | 220 | 236 | 221 | 229 | 231 | 233 | 248 | 243 |
| 11 | 259 | 199 | 214 | 207 | 210 | 201 | 208 | 216 | 211 | 225 | 213 |
| 12 | 60 | 52 | 57 | 53 | 53 | 55 | 52 | 58 | 53 | 53 | 61 |
| 13 | 283 | 217 | 235 | 218 | 233 | 216 | 230 | 237 | 234 | 245 | 246 |
| 14 | 98 | 84 | 83 | 79 | 82 | 82 | 84 | 84 | 87 | 85 | 88 |
| 15 | 142 | 155 | 159 | 148 | 155 | 145 | 150 | 142 | 163 | 167 | 154 |
| 16 | 24 | 25+ | 24 | 25 | 26 | 24 | 25 | 24 | 24+ | 28 | 25 |
| 17 | 24 | 25+ | 25 | 25 | 26 | 25 | 26 | 25 | 26 | 28 | 25 |
| 18 | 151 | — | 210 | 207 | 207 | 212 | 213 | 216 | — | 233 | 237 |
| 19 | 151 | — | 209 | 207 | 208 | 213 | 214 | 218 | — | 234 | 233 |
| 20 | 154 | 206 | 217 | 214 | 217 | 226 | 222 | 233 | 240 | 242 | 246 |
| 21 | 154 | 208 | 215 | 214 | 214 | 224 | 224 | 232 | 236 | 242 | — |
| 22 | 24 | 26 | 26 | 25 | 26 | 27 | 26 | 26 | 23 | 28 | — |
| 23 | 23 | 27 | 24 | 24 | 27 | 27 | 26 | 27 | 24 | 27 | — |
| 24 | 250 | 214 | 214 | 213 | 212 | 217 | 224 | 236 | 238 | 241 | — |
| 25 | 247 | 210 | 212 | 211 | 213 | 220 | 223 | 237 | 241 | 240 | — |
| 26 | 250 | 215 | 217 | 220 | 215 | 219 | 227 | 240 | 240 | 243 | — |
| 27 | 252 | 212 | 217 | 217 | 216 | 221 | 225 | 239 | 243 | 241 | — |
| 28 | 464 | 377 | 392 | 388 | 396 | 392 | 392 | 421 | 414 | 422 | — |
| 29 | 96 | 78 | 82 | 80 | 83 | 82 | 82 | 79 | 90 | 90 | — |
| 30 | 61 | 68 | 66 | 66 | 70 | 66 | 69 | 65 | 74 | 71 | — |
| 31 | 124 | 83 | (97) | 81 | 87 | 82 | 93 | 84 | 95 | 103 | 88 |
| 32 | 82 | 74 | 75 | 77 | 69 | 73 | 75 | 77 | 73 | 76 | 77 |
| 33 | 66 | 47 | 51 | 48 | 34 | 45 | 49 | 50 | 41 | 57 | 55 |
| 34 | 168 | 135 | 137 | 133 | 135 | 137 | 148 | 139 | 144 | 142 | 147 |
| 35 | — | 37,5 | 36,5 | 37 | 36 | — | 36 | 35 | 39 | 38 | — |
| 36 | 39 | 37 | 36,5 | 39 | 36 | — | 36 | — | 38 | 37 | — |

year assuming that this rate is an integer. A similar estimate was made from the teeth of another dolphin, PEM 1519/99, held captive for four years and two months, which measured approximately 2,22 m in length when captured. An estimate of the number of growth layers present at the time of capture (about four) can be made from the growth curve for *T. aduncus* (Fig. 37). Since there is a tendency to slightly underestimate the length of a living dolphin owing to hunching and curving of the body, it is probable that this number is closer to five than to four. At death 8,5 growth layers were counted in the dentine (Table 77). The remaining four layers would have been deposited in just over four years, indicating an accumulation rate of one layer per year.

Another indirect estimate of the accumulation rate can be made by comparing the initial

Table 77:

Counts of dentine growth layers in teeth of 17 *Tursiops aduncus* from the SE coast of southern Africa. The thickness of layer one is measured close to the apex of the pulp cavity.

| Catalogue Number | Total length (mm) | No. of growth layers | Pulp cavity | Comments |
|---|---|---|---|---|
| PEM 1519/76 | 2 400 | 15 + | Closed | Layer 1:0,9 mm. Secondary dentine. |
| PEM 1519/77 | (2 430) | — | Closed | Worn tip. Secondary dentine. |
| PEM 1519/79 | — | 13 + | Closing | Layer 1:0,8 mm. Secondary dentine. |
| PEM 1519/80 | 1 790 | < 1 | Open | Layer 1:0,3 mm. |
| PEM 1519/82 | 2 410 | 11 + | Closed | Layer 1:0,9 mm. Secondary dentine. |
| PEM 1519/86 | 1 600 | < 1 | Open | Layer 1:0,2 mm. |
| PEM 1519/99 | — | 8,5 | Open | Layer 1:0,7 mm. |
| PEM 1519/87 | 2 200 | 3,5 | Open | Layer 1:0,75 mm. |
| PEM 1520/09 | — | 2,5 | Open | Layer 1:0,95 mm. |
| PEM 1520/48 | 2 480 | 11 + | Closed | Layer 1:0,7 mm. Secondary dentine. |
| PEM 1520/62 | 1 975 | 2 | Open | Layer 1:0,75 mm. |
| PEM 1520/77 | 1 290 | < 1 | Open | Layer 1:0,75 mm. |
| PEM 1520/78 | 1 340 | < 1 | Open | Layer 1:0,15 mm. |
| PEM 1520/79 | 1 420 | < 1 | Open | Layer 1:0,2 mm. |
| PEM 1520/80 | 1 420 | < 1 | Open | Layer 1:0,3 mm. |
| PEM 1520/82 | 2 330 | 14 + | Closing | Layer 1:0,85 mm. Secondary dentine. |
| PEM 1520/83 | 2 350 | 12 + | Closing | Layer 1:1,0 mm. Secondary dentine. |
| PEM 1521/16 | — | 3,5 | Open | Layer 1:0,95 mm. |

part of the growth curve in Fig. 37 with the growth of a male *T. aduncus*, Dolfie, born in captivity at the Port Elizabeth Oceanarium. This dolphin was estimated to be a little over 1,5 m at 10 months of age and measured 1,95 m at 18 months, 2,20 m at 35 months, 2,27 m at 49 months, 2,27 m at 56 months, 2,23 m at 57 months, 2,25 m at 58 months, 2,25 m at 61 months and 2,30 m at 63 months. When these measurements are superimposed on the curve in Fig. 37, the best fit of the points to the curve is reached when the accumulation rate of dentine layers is equal to one per year.

Ross (1977) from an examination of five specimens with fused vertebral epiphyses, suggested that specimens of *T. aduncus* with obliterated pulp cavities were physically mature. An additional five specimens examined in the present study (Table 73) confirmed this suggestion. Other specimens with closed pulp cavities have been classed as physically mature.

*Growth and development*: The total lengths of 12 neonatal *T. aduncus* ranged from 0,838–1,12 m, with a mean length of 1,009 m. Four of these were born in captivity ($\bar{x}$ = 963 mm; 880–1 092 mm). The mean mass of seven neonates was 12,5 kg (9,09–14,83 kg).

A growth curve has been drawn (Fig. 37) for 33 specimens for which both length and dentine layer counts were available. For plotting purposes, the thickness of dentine deposited in teeth with less than one dentine layer was calculated as a fraction of the average thickness of layer one (0,84 mm; n = 11). Specimens with closed pulp cavities (physically mature animals) have been grouped together. As the sample size is small the curve has been drawn by eye to pass through the points of mean length at birth and mean length at physical maturity; data for males and females have been combined. The initial form of the curve is similar to those for other marine mammals (Bryden, 1972) in which growth is especially rapid in the first two postnatal years and closely resembles the growth pattern of *T. truncatus* from Florida (Sergeant *et al.*, 1973). The upper part of the curve is very approximate since the sample size is very small and data from males and females are combined. It is also probable that the growth patterns of *T. aduncus* are similar to those of other delphinids such as *Stenella coeruleoalba*, *S. attenuata* and *S. longirostris* (Kasuya *et al.*, 1974; Perrin *et al.*, 1976, 1977a) in which the growth curves, particularly those of males, were complicated by growth rates prior to attainment of sexual maturity, and could not be fitted by a single equation.

The mean lengths of five males and four females known to be physically mature from the fusion of the vertebral epiphyses were 2,386 m (2,320–2,520 m) and 2,414 m (2,350–2,480 m) respectively. An unsexed specimen was mature at a length of 2,05 m. The mean lengths of ten males and five females, judged to be mature on account of the occluded pulp cavities of their teeth, were 2,398 m and 2,393 m respectively. The mean length for all 16 specimens was 2,375 m.

Total mass, partial body mass and intestine length for 21 *T. aduncus* are provided in Table 78. The length-mass relationship calculated previously for this species (Ross, 1977) may be inaccurate since it included some values from stranded specimens which were not necessarily normal in mass though animals that were obviously emaciated were excluded from the calculation.

In emaciated animals, the loss of mass is reflected in the proportionate mass of blubber and meat, and the combined values of blubber and meat masses provide a means of estimating whether the mass of a stranded animal is normal. The combined blubber and meat mass in 12 specimens of normal mass (range 45,8–183,8 kg) captured in shark nets or killed in capture operations constituted 47,2–58,2% of total mass, with a mean of 52,7% (data from table 78 and Ross, 1977). This sample excludes a juvenile animal with a total mass of 39,9 kg and a combined blubber and meat mass of 39,2% of total mass. On this basis, the masses of four stranded specimens could be considered normal, and these have been included in the present calculation of the length-mass relationships (PEM 1516/34, 53%; PEM 1519/76, 50,3%; PEM 1520/35, 48,5%; PEM 1520/88, 56,9%). In addition data have been included from four animals captured by the Port Elizabeth Oceanarium during 1977 and which were weighed and measured on the day of capture (PEO–2–77, 2,42 m female, 178 kg; PEO–3–77, 2,36 m female, 175,5 kg; PEO–5–77, 1,95 m male, 84 kg; PEO–7–77, 2,17 m female, 137,5 kg) and from PEM 1518/99, a 1,525 m male, weighing 40 kg, taken in the shark nets. Length and mass data for all seven available neonates have been used in the regressions.

The length-mass regression for these 29 specimens was—

$$M = 8{,}0 \times 10^{-9} X^{3{,}057}$$

M = mass (kg) and X = total length (mm).

Comparisons of regressions calculated for all (18) males and all (11) females, and all (12) eastern Cape and all (17) Natal specimens respectively showed no significant differences.

*Reproduction:* Ovaries were collected from 10 *T. aduncus* and data from these are presented in Table 79. The following comments are based on these data and on data from nine females given in Ross (1977).

The length at sexual maturity in females lies between about 2,13 m and 2,30 m. All but one of eight females longer than 2,31 m were sexually mature. Estimates of the length at sexual maturity may also be made from the length at physical maturity. Laws (1956, *in* Bryden, 1972) showed that in many marine mammal species the length of the female at puberty is approximately 86% of that of the physically mature animal. Sergeant *et al.* (1973) estimated this figure to be 90% in *T. truncatus* from Florida. Using the latter figure, the length at puberty of four physically mature *T. aduncus* is estimated to be 2,172 m (range 2,115–2,232 m). This estimate agrees well with that obtained directly.

The age at sexual maturity is unknown, though Ross (1977) suggested that one female, PEM 1517/96, matured at less than nine years of age.

The size of the largest corpus albicans in PEM 1520/48 suggests that ovulation had occurred fairly recently and that this physically mature female was still reproductively active. However the mammary glands were too decomposed to determine whether lactation was still

TABLE 78:

Total mass, partial body mass and intestine length for 21 *Tursiops aduncus* from the SE coast of southern Africa. Partial body mass is expressed as a percentage of total mass.

| Catalogue Number | Sex | Total length (mm) | Total mass (kg) | Blubber | Meat | Heart Lung Trachea | Heart | Liver | Kidneys | Intestine length (m) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PEM 1520/28 | ♀ | 950 | 9,7 | 22,5 | 14,1 | — | — | — | — | — | Born in captivity |
| PEM 1520/91 | ♂ | 1 040 | 13,7 | 23,8 | 16,5 | 4,7 | 0,71 | 1,8 | 0,98 | 6,6 | Stranded alive |
| PEM 1521/00 | ♀ | 1 045 | 14,1 | — | — | — | — | — | — | — | Stranded |
| PEM 1521/17 | ♂ | 1 060 | 14,8 | 22,6 | 17,9 | 4,5 | 0,84 | 1,8 | 0,98 | 6,98 | Stranded. Stillborn? |
| PEM 1520/77 | ♂ | 1 290 | 37,7 | 14,0 | 22,2 | 3,9 | 0,54 | — | — | 11,5 | — |
| PEM 1520/35 | ♀ | 1 340 | 30,9 | 19,9 | 28,7 | — | — | — | — | — | — |
| PEM 1520/78 | ♂ | 1 340 | 39,9 | 17,0 | 22,2 | 4,2 | 0,76 | — | — | 12,9 | Caught in shark nets |
| PEM 1520/79 | ♀ | 1 420 | 48,1 | — | — | — | — | — | — | — | Stranded |
| PEM 1520/80 | ♀ | 1 420 | 45,8 | 15,2 | 38,6 | 3,8 | 0,45 | — | — | 11,95 | Caught in shark nets |
| PEM 1519/86 | ♀ | 1 600 | 41,7 | 25,0 | — | — | — | — | — | — | Stranded |
| PEM 1520/81 | ♂ | 1 720 | 69,9 | 15,7 | 33,8 | 3,6 | 0,49 | — | — | 15,6 | Caught in shark nets? |
| PEM 1520/11 | ♀ | 1 780 | 46,1 | — | — | — | — | — | — | — | Stranded. Emaciated |
| PEM 1519/80 | ♂ | 1 790 | 63,5 | 18,6 | 31,4 | — | — | — | — | — | Caught in shark nets |
| PEm 1519/87 | ♀ | 2 200 | 116,6 | 16,7 | 27,4 | — | — | — | — | — | Stranded |
| PEM 1520/34 | ♂ | 2 330 | 188,3 | — | — | — | — | — | — | — | — |
| PEM 1520/82 | ♂ | 2 330 | 167,0 | 14,4 | 43,8 | 3,3 | 0,46 | — | — | 17,6 | Caught in shark nets |
| PEM 1520/83 | ♂ | 2 350 | 183,8 | 17,0 | 39,0 | 4,0 | 0,59 | — | — | 18,0 | Caught in shark nets |
| PEM 1520/88 | ♂ | 2 350 | 137,0 | 19,2 | 37,7 | 5,6 | 0,60 | 2,7 | 0,89 | 20,4 | Stranded |
| PEM 1519/75 | ♂ | 2 380 | 182,8 | — | — | — | — | — | — | — | Stranded |
| PEM 1519/76 | ♂ | 2 400 | 161,1 | 15,5 | 34,9 | — | — | — | — | — | — |
| PEM 1519/82 | ♂ | 2 410 | 157,4 | 17,6 | 39,8 | — | — | — | — | — | Caught in shark nets |
| PEM 1519/77 | ♂ | (2430) | 167,4 | 16,5 | 36,0 | — | — | — | — | — | Caught in shark nets |

(  ) denotes approximate measurement.
PEM 1521/17–adrenal glands 3,4 g together-brain 738 g.

Table 79:

Ovarian data for nine *Tursiops aduncus* from the SE coast of southern Africa.

| Catalogue number | Total length (mm) | Ovarian | | Corpora albicantia diameter (mm) (and index) | Total no. of corpora | Comments |
|---|---|---|---|---|---|---|
| | | Dimensions (mm) | Mass (g) | | | |
| PEM 1520/28 | 950 | 23 × 11 × 9 | 1,3 | 0 | 0 | Neonate |
| | | 24 × 12 × 9 | 1,3 | 0 | | |
| PEM 1521/00 | 1 045 | 26 × 13 × 10 | 1,8 | 0 | 0 | Neonate |
| | | 28 × 15 × 8 | 1,7 | 0 | | |
| PEM 1520/35 | 1 340 | 27 × 11 × 7 | 0,9 | 0 | 0 | Immature |
| | | 24 × 11 × 6 | 0,9 | 0 | | |
| PEM 1520/79 | 1 420 | 31 × 15 × 10 | 2,6 | 0 | 0 | Immature |
| | | 30 × 14 × 16 | 2,6 | 0 | | |
| PEM 1520/80 | 1 420 | 21 × 12 × 8 | 1,1 | 0 | 0 | Immature |
| | | 21 × 10 × 9 | 1,0 | 0 | | |
| PEM 1520/11 | 1 780 | 31 × 15 × 8 | 1,9 | 0 | 0 | Immature |
| | | 30 × 10 × 10 | 1,5 | 0 | | |
| PEM 1520/18 | 2 135 | 36 × 17 × 15 (L) | 4,3 | 0 | 0 | Several follicles up to 1 mm diameter |
| | | 34 × 19 × 12 (R) | | | | |
| PEM 1519/87 | 2 200 | 32 × 14 × 8 | 2,3 | 0 | 0 | Immature |
| | | 36 × 11 × 7 | 2,0 | 0 | | |
| PEM 1520/24 | (2 380)* | 34 × 20 × 13 (L) | 5,0 | 13 (1105) | 1 | Large subsurface corpus. |
| | | 36 × 17 × 11 (R) | 3,9 | 0 | | Several follicles up to 1,5 mm diam. |
| PEM 1520/48 | 2 480 | 39 × 30 × 18 (L) | 9,6 | 13(1359); 11(880); 10(850); 8(392);8(392) | 5 | Five prominent corpora. No foetus found. State of lactation unknown. |
| | | 29 × 14 × 13 (R) | 2,9 | 0 | | |

( )* denotes approximate measurement.

in progress. A similar situation was found in two other physically mature lactating females, PEM 1517/60 and PEM 1519/07, which had been examined previously and in which the ovaries contained three and four corpora albicantia respectively.

In seven of the eight sexually mature females corpora were present in the left ovary only and in five of these females the left ovary was heavier than the right. Harrison *et al.* (1972) showed that in a number of odontocete species the left ovary is usually active before the right.

The normal calving interval in *T. aduncus* is unknown. One captive female, Haig, PEM 1516/00, gave birth to two calves in successive years. Both calves died soon after birth. In the Port Elizabeth Oceanarium a second captive female, Dimple, successfully gave birth to two calves in December 1968 and December 1972. A third calf, born on 10 November 1975, was probably stillborn as its lungs were found to be devoid of air at a *post mortem* examination. On the same day the adult male in the pool attempted to mate with Dimple, but it is unknown whether conception occured then. In the early hours of 14 November 1976 Dimple gave birth to a fourth calf, PEM 1520/28, which was dead when seen at daylight. Though these records indicate that females can conceive in successive years, both instances occurred after the loss of a calf and therefore do not represent the normal situation. Essapian (1963), for three captive *T. truncatus* in Florida, recorded that successive births were always separated by two years.

The gestation period is approximately 12 months. The maximum intervals between the conception and birth of Haig's second calf and Dimple's fourth calf were 364 days and 368 days respectively. However, the exact date of conception is uncertain. Tayler and Saayman (1972) give figures of 342 days and 351 days respectively for the gestation periods of Dimple's and Haig's first calves, based on an increase in appetite and the onset of marked behavioural changes, though they do not mention the nature of these changes.

Two calves born in captivity suckled for six and 11 months before taking fish. There is some evidence that one of these calves continued suckling up to the age of 29 months (Ross, 1977). The stomachs of three calves, 1,34 m, 1,34 m and 1,42 m in length contained milk only.

A fourth animal, 1,72 m in length, had milk and the remains of a prawn, two cephalopod statoliths and a fragment of a fish otolith in its stomach. The stomach of PEM 1519/80, 1,79 m in length, contained a single cephalopod beak and that of PEM 1516/34, 1,50 m in length, contained fishbones. The limited data suggest obligate nursing occurs up to body lengths of about 1,5 m, or until about six months of age (Fig. 37).

Data on the testes of 14 males are presented in Table 80; these have been combined for analysis with data from 11 specimens reported on previously. A scatterplot of combined testes mass against body length is shown in Fig. 38 for 22 specimens. The points indicate that onset of sexual maturity occurs at lengths of about 2,1–2,4 m, with a probable mean of about 2,3 m. The lengths of males producing sperm ranged from 2,24–2,54 m.

Owing to the limitations of the ageing technique once the pulp cavity has closed, the age at sexual maturity cannot be established. However two males, PEM 1517/69 and PEM 1515/83, which had 11 and nine dentine layers and combined testes mass of 665 g and 805 g respectively were considered to be maturing. All seven mature males with a combined testes mass of over 1 000 g had 10+ dentine growth layers.

*Food and feeding*: Identified food remains from 13 stomachs examined in the most recent material are listed in Table 81.

Three genera of cephalopods and 29 species of fish formed 40% and 60% of 794 items in the 22 stomachs examined to date. Only one elasmobranch *Rhizoprionodon acutus* (600 mm TL) was recorded. Benthic or reef dwelling species formed 82% of all fish recorded, showing that *T. aduncus* feeds on or close to the sea floor. The limited data on the depths to which these species occur (Smith, 1965; Barnard, 1925; Roeleveld, 1972) indicate that *T. aduncus* feeds at depths of not more than 200 m. Only 10% of the fish recorded were pelagic forms (*Sardinops, Cypselurus, Pomatomus, Trichiurus*) and constituted less than 4% of all items recorded.

The stomach contents of nine animals caught in the anti-shark nets on the Natal coast contained 88% fish and 12% cephalopods (440 items). Of the fish, 75% were pomadasyids, predominantly *Pomadasys olivaceum*. By contrast the stomachs of nine stranded *T. aduncus* from the eastern Cape contained 66% cephalopods (318 individuals) and 34% fish. The high proportion of cephalopods is partly due to the presence of 209 beaks in one animal. Even if this animal is omitted from the sample, cephalopods still constitute 39% of all food items (109). While there may be regional differences in the diet of *T. aduncus* perhaps related to the availability of cephalopods along the coast, it is possible that cephalopod beaks in an identifiable condition, are retained for a longer period in the stomach of a stranded dolphin than are fish remains such as otoliths, resulting in an over-estimate of the proportion of cephalopods in stranded animals.

Though most prey animals are less than 300 mm in length, several *Merluccius* 500–600 mm in length have been recorded in addition to the shark mentioned above.

In the Port Elizabeth Oceanarium an adult female about 2,35 m in length and weighing an average of 156,2 kg (range 151–158 kg) consumed 6,05 kg/day over a five month period, or 3,87% body mass/day. This feeding rate is comparable with that of 4,2% body mass/day given for *T. truncatus* in captivity by Sergeant (1969).

The feeding rates of two young *T. aduncus* held in the same tank as the adult female were

TABLE 80:

Reproductive data for one *Tursiops truncatus* and 14 *T. aduncus* males from the SE coast of southern Africa.

| Catalogue Number | Total length (mm) | No. of dentine layers | Size of testis (mm) | | Mass of testis (g) | | | Diameter of tubules ($\mu$) | Comments |
|---|---|---|---|---|---|---|---|---|---|
| | | | left | right | left | right | total | | |
| *T. truncatus* | | | | | | | | | |
| PEM 1521/10 | 2 780 | 6+ | 85 × 18 | 85 × 18 | 16,7 | 18,7 | 35,4 | — | — |
| *T. aduncus* | | | | | | | | | |
| PEM 1520/91 | 1 040 | 0 | *30 × 9 × 7 | 32 × 8 × 7 | 1,1 | 1,1 | 2,2 | 45 | Neonate |
| PEM 1521/17 | 1 060 | 0 | *58 × 11 | 60 × 9 | 2,3 | 2,6 | 4,9 | — | Neonate |
| PEM 1520/77 | 1 290 | < 1 | *37 × 10 × 9 | 32 × 10 × 9 | 2,5 | 2,5 | 5,0 | 37 | Immature |
| PEM 1520/78 | 1 340 | < 1 | *42 × 11 × 8 | 44 × 11 × 9 | 2,6 | 2,7 | 4,3 | 40 | Immature |
| PEM 1520/81 | 1 720 | — | *60 × 12 × 11 | 51 × 14 × 10 | 5,1 | 4,7 | 9,8 | 34 | Immature |
| PEM 1519/80 | 1 790 | < 1 | *50 × 12 | 52 × 12 | 3,6 | 4,1 | 7,7 | — | — |
| PEM 1521/16 | 2 340 | 3,5 | 75 × 22 | 70 × 20 | 13,7 | 12,0 | 25,7 | — | — |
| PEM 1520/19 | 2 300 | — | 125 × 30 | 135 × 30 | 57 | 57 | 114 | 52 | — |
| PEM 1520/88 | 2 350 | — | 110 × 30 | 110 × 28 | 40 | 37 | 77 | 50 | Immature |
| PEM 1520/82 | 2 330 | 14+ | 170 × 75 | 180 × 75 | 351 | 379 | 730 | — | — |
| PEM 1520/83 | 2 350 | 12+ | 235 × 75 | 250 × 75 | 318 | 322 | 640 | (120) | Sperm in tubules, absent from epididymis. Tissue macerated. |
| PEM 1519/76 | 2 400 | 15+ | 220 × 70 | 220 × 70 | — | — | 1 158 | — | — |
| PEM 1519/82 | 2 410 | 11+ | 220 × 70 | 240 × 75 | 633 | 672 | 1 305 | (156) | No sperm seen in tubules |
| PEM 1519/77 | (2 430) | — | 190 × 100 | 230 × 100 | 800 | 758 | 1 558 | — | Tissue mature, but macerated. No sperm seen in tubules. |

( ) denotes approximate measurement
* not sided.

TABLE 81:
Numbers of prey items recorded from stomach contents of 12 *Tursiops aduncus* from the SE coast of southern Africa

| Prey Items | PEM 1519/75 | PEM 1519/76 | PEM 1519/77 | PEM 1519/80 | PEM 1519/82 | PEM 1519/87 | PEM 1520/24 | PEM 1520/48 | PEM 1520/81** | PEM 1520/82 | PEM 1520/83 | PEM 1520/88 | PEM 1521/16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CARCHARINIDAE | | | | | | | | | | | | | |
| *Rhizoprionodon acutus* | | | 1 | | | | | | | | | | |
| CLUPEIDAE | | | | | | | | | | | | | |
| *Sardinops ocellata* | | | | | 2 | | | | | | | | |
| SYNODONTIDAE | | | | | | | | | | | | | |
| *Saurida undosquamis* | | 1 | | | | | | | | 2 | 3 | | |
| EXOCOETIDAE | | | | | | | | | | | | | |
| *Cypselurus* sp. | | | | | | | | | | 3 | | | |
| PETALICHTHYIDAE | | | | | | | | | | | | | |
| *Petalichthys capensis* | | 1 | | | | | | | | | | | |
| GADIDAE | | | | | | | | | | | | | |
| *Merluccius capensis* | | | | | | 1 | | | | | | | 1 |
| SOLEIDAE | | | | | | | | | | | | | |
| *Austroglossus pectoralis* | | | | | | | | | | | | 1 | |
| SERRANIDAE | | | | | | | | | | | | | |
| *Epinephalus tauvina* | | | | | | | | | | | 1 | | |
| APOGONIDAE | | | | | | | | | | | | | |
| *Apogon* sp. | | | 1 | | | | | | | | | | |
| CARANGIDAE | | 9 | | | | | | | | | 13 | | |
| SCIAENIDAE | | | | | | | | 1 | | | | | |
| *Argyrosomus hololepidotus* | | | | | | 4 | | | | | | 6 | |
| *Otolithes ruber* | 1 | | | | | | | | | | | | |
| *Johnius* sp. | | | | | | | | | 2 | | | | |
| POMADASYIDAE | | | | | | | | | | | | | |
| *Pomadasys olivaceum* | | 21 | | | 9 | | | | | | 126 | | |
| *Pomadasys commersonni* | | | 1 | | | | | | | | 4 | | |
| SPARIDAE | | | | | | | | | | | | | |
| *Rhabdosargus thorpei* | | 1 | 1 | | | | | | | | | | |
| *Diplodus sargus* | | 1 | 1 | | | | | | | | | | |
| *Chrysoblephus puniceus* | | | 1 | | | | | | | | | | |
| *Pagellus natalensis* | | | | | | | | | | | 1 | | |
| TRICHIURIDAE | | | | | | | | | | | | | |
| *Trichiurus lepturus* | | | 6 | | | | | | | | 5 | | |
| TRIGLIDAE | | | | | | | | | | | | | |
| *Trigla queketti* | | | | | | | | | | | 1 | | |
| UNIDENTIFIED FISH | | | 1 | | | | | | | | 7 | | |
| LOLIGINIDAE | | | | | | | | | | | | | |
| *Loligo reynaudi* | | | | 1 | 1 | * | 1 | 209 | | | 3 | 3 | 3 |
| SEPIIDAE | | | | | | | | | | | | | |
| *Sepia* spp. | | 7 | 2 | | 3 | | | | | 4 | 1 | | |
| OCTOPODIDAE | | | | | | | | | | | | | |
| *Octopus* sp. | | | | | | | | | | | 1 | | |

* Two upper beaks present
** Fragments of a prawn present

measured over a 55-day period and that of a third animal for a period of 102 days. The lengths and average mass of these dolphins were 1,93 m and 83 kg; 2,17 m and 123 kg; and 2,17 m and 126 kg; and their feeding rates were 6,7%, 5,6% and 4,7% body mass/day respectively. The progressive decline in the feeding rate with increase in body mass is expected since the growth rate declines quite rapidly in dolphins within this length range (Fig. 37).

Sergeant (1969) noted that the heart mass/feeding rate ratio was similar in *Lagenorhynchus obliquidens* (0,109), *Phocoenoides dalli* (0,116) and *T. truncatus* (0,119). The same ratio for *T. aduncus*, based the mean heart mass (0,546% body mass) of five specimens over 2,0 m in length, and the feeding rate of the adult female given above, is 0,141, which is considerably higher than the figures quoted for the other species.

*Parasites*: Eighteen specimens of the parasitic cirripede *Xenobalanus globicipitis* were counted on the trailing edge of the flukes in PEM 1520/79, 1,42 m in length. These barnacles were frequently noted on the dorsal fin and flukes of *T. aduncus* observed in Algoa Bay during capture operations.

One and two cyamids were collected from the lip of the blowhole of PEM 1520/81 and PEM 1520/83 respectively.

Nematodes were collected from the pterygoid sinuses of three animals but they have not yet been identified. Nematodes were present in two of eight stomachs checked for parasites and numerous tapeworms were collected from the intestine of one specimen.

Lungworms were collected from four suckling animals and were identified as *Halocercus lagenorhynchi* in three of these specimens.

*School size*: The size of 129 schools of *T. aduncus* was estimated from sightings by the author along the eastern Cape coast, particularly in Algoa Bay. Owing to the difficulties of counting free ranging groups estimates of numbers of animals have been conveniently grouped into broad categories as follows (number of sightings in parentheses): 1–5 (7); 6–10 (9); 11–20 (20); 20–50 (32); 50–100 (24); 100–300 (33); 300–1 000 (3). On one occasion 1 600–2 000 animals were observed in several groups. At least 14 sightings placed in the 100–300 category consisted of several groups often well separated, containing 20–50 animals; four sightings in the 50–100 category and two sightings in the 300–1 000 category also consisted of several smaller groups. The data suggest that the average functional group size of *T. aduncus* lies between 20 and 50 animals; though such groups frequently form larger aggregations resulting in the observed bimodal distribution of group sizes.

A similar group size frequency distribution was found by Saayman and Tayler (1973) at Plettenberg Bay where the mean number of dolphins per sighting was 140 (n = 93). Most sightings (32) were of groups in the 100–500 category. However, if these authors' categories of 20–30 dolphins and 30–50 dolphins are combined (18 sightings), their frequency distribution matches more closely the bimodal distribution found in the present study. Saayman and Tayler (1973) noted that large schools of *T. aduncus* would hunt in four or five widely dispersed groups which suggests that the functional group size is less than the mean of 140 animals.

### DISTRIBUTION AND MIGRATION

*T. aduncus* is widely distributed in the coastal waters of the Indian Ocean. Specimens have been described from the Red Sea, Pakistan, India, China seas, Thailand, Indonesia and Australia (Pilleri and Gihr, 1972, 1973/74).

In southern African waters *T. aduncus* is encountered frequently along the coasts of the eastern Cape and Natal. The western limit of distribution is uncertain. This species was recorded throughout the year at Plettenberg Bay (23° 20′ E) (Saayman *et al.*, 1972).

There are only three records of *T. aduncus* west of Cape Agulhas, at Gordon's Bay, Walker Bay (Ross, 1977) and at Danger Point (Best, *in litt.*). As the region between Cape Agulhas and Mossel Bay is poorly sampled with regard to small cetaceans the status of *T. aduncus* there is uncertain.

North of Natal, for the coast of Mocambique, there is a single record of *T. aduncus* based on excellent underwater photographs taken by Mr. K. Korsman and now in the PEM files. The dolphins were photographed at Massinga (23° 20′S, 35° 25′E) in June 1969. This appears to be the second record of the species between Natal and the Red Sea. The other record is based on a skull in the British Museum (91.5.10.1) collected at Pemba Island, East Africa (05° S, 39° E).

It is apparent from strandings and sightings that *T. aduncus* occurs in eastern Cape waters throughout the year (Table 82). Although data for Natal are more limited it also appears that the species occurs there all year round.

Studies on movements of *T. aduncus* in and around Algoa Bay are in progress, using animals with numbers freeze-branded on the dorsal fin. Brands made of copper and having 170 g copper/sq. cm of branding surface were cooled in liquid nitrogen and applied to the dry dorsal fin surface for 15 seconds. Trials on a captive animal, using branding times of 5, 10 and 15 seconds showed that the longest time was most effective. The 15 second brand has remained unchanged and highly visible for five years.

Only one of the three animals marked to date has been resighted. This dolphin was an adult male, Daan, which was released one mile offshore in Algoa Bay on 9 August 1976 after nine years in captivity in the Port Elizabeth Oceanarium. Daan was subsequently resighted in Plettenberg Bay, approximately 210 km west of the point of release, in a large school of dolphins in November 1976. Subsequent resightings were made in Algoa Bay on 16 and 28 July 1977. These resightings are of interest not only as an indication of the potential home range of a school of dolphins but also of the ability of an animal to rehabilitate into its natural environment after an extended period in captivity.

Five other dolphins observed in Algoa Bay during capture operations have provided information on home range and residency of a single school of some 200 animals (including Daan) over a period of 18 months (Table 83). One of these was a young Common Dolphin *Delphinus delphis* which was observed in the school of *Tursiops* on six occasions. The remaining four animals were *T. aduncus* with distinctive injuries or deformities which permitted re-identification with considerable confidence. The limited evidence from resightings of these animals suggests that this school was present in Algoa Bay on at least ten occasions over an 18 month period during which it may have moved up to 200 km distant. The data do not indicate that this school is resident, nor is it necessarily the only school, for far larger groups have been seen on occasion in this area.

## Genus *DELPHINUS* Linnaeus

*Syst. Nat.*, ed. 10, 1: 77; type species *Delphinus delphis* Linnaeus, 1758.

These are small to medium sized dolphins attaining lengths of up to 2,75 m. They are slender, streamlined dolphins, with a small melon tapering to a distinct apex. The snout is distinct and long, from 6,2 to 10,8% of total body length.

Laterally the colour pattern is in the form of a figure of eight. A narrow dark stripe is present ventro-laterally between the gape and the vent (Fig. 23).

The rostrum is long (53–70% CBL) and narrow, its basal width about one third of its length. There are 45–66 teeth in each jaw. The deep longitudinal grooves on each side of the palate are diagnostic for this genus. Vertebrae 71–76.

One species *Delphinus delphis* Linn., widely distributed in temperate and tropical waters, is presently accepted by most authors. The true status of *D. tropicalis* van Bree is not yet certain (Rice, 1977). The statuses of *D. bairdi* Dall and *D. capensis* Gray are discussed below.

### *Delphinus delphis* Linnaeus, 1758
### Common Dolphin

*Delphinus delphis* Linnaeus, 1758: 77 (type, non-existent, name based on common dolphin of Artedi; type locality "Oceano Europaeo"); Sclater, 1901: 210; FitzSimons, 1920: 226; Allen, 1939b; 250; Roberts, 1951: 228; Ellerman, Morrison-Scott and Hayman, 1953: 329; Barnard, 1954: 27; Best, 1971: 5; van Bree and Purves, 1972: 372; Best and Ross, 1977: 494.

TABLE 82:

Seasonal occurrence of *Tursiops aduncus* in Eastern Cape and Natal waters. The data are taken from Ross (1977; present study) and sightings made by the author.

| | January | February | March | April | May | June | July | August | September | October | November | December | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EASTERN CAPE | | | | | | | | | | | | | |
| Specimens | 2 | 2 | 5 | 2 | 3 | 4 | 2 | 3 | — | 2 | 8 | 3 | 36 |
| Sightings | 8 | 17 | 8 | 19 | 10 | 11 | 10 | 12 | 15 | 8 | 16 | 4 | 138 |
| NATAL | | | | | | | | | | | | | |
| Specimens | — | — | — | — | 2 | 2 | 3 | 1 | 4 | 5 | 1 | — | 18 |
| Sightings | 1 | 2 | — | — | — | — | — | 1 | — | — | — | — | 4 |

Table 83:

Resighting data for five *Tursiops aduncus* and one *Delphinus delphis* observed in Algoa Bay during capture operations. X indicates presence in the school.

| Date | *Delphinus* | Daan | Notch in Fin Tip | Humpchest | Fin Removed | Scratched Melon |
|---|---|---|---|---|---|---|
| 26.03.76 | X | | | | X | |
| 09.08.76 | | X* | | | | |
| 10.08.76 | X | | X | | | |
| 18.04.77 | X | | X | | | |
| 16.07.77 | | X | | | | |
| 28.07.77 | X | X | | X | | |
| 17.08.77 | X | | | | | X |
| 19.08.77 | | | | | X | |
| 06.09.77 | X | | | | | |
| 12.09.77 | | | | X | | |
| 13.09.77 | | | | | | X |

* Date of release from captivity.

*Delphinus capensis* Gray, 1828: 2 (type specimen BM 41.1734, Cape of Good Hope); True, 1889: 59; Sclater, 1901: 211; Allen, 1939b; 250; Ellerman, Morrison-Scott and Hayman, 1953: 329; Banks and Brownell, 1969: 262; Best 1971: 6; van Bree and Purves, 1972: 372.
*Delphinorhynchus capensis* Smith, 1834: 236 (= *D. capensis* Gray).
*Delphinus longirostris* Gray, 1866: 241 (= *D. capensis* Gray); True, 1889: 58.

## Records and material

Details of 60 records of *Delphinus delphis* from the SE coast are provided in Table 84, and sight records are listed in Table 85. Fig. 39 illustrates the localities of these records; localities of specimens and sightings may include more than one record.

## Specific status and characters

In 1828 Gray described *Delphinus capensis*, based on a skull collected at the Cape of Good Hope, which differed from skulls of *Delphinus delphis* Linnaeus in its proportionately longer rostrum. Subsequently Gray (1846, 1866) placed *D. capensis* and the type of *Delphinus longirostris* Cuvier, 1829 as junior synonyms of *Delphinus longirostris* Gray, 1828; again Gray stated that the main distinguishing feature of this assemblage was the long rostrum (about 65% of CBL), though as pointed out by van Bree and Perrin (1977), Gray could not have re-examined the skull of *D. capensis* since it was only removed from the mounted skin in 1884.

*Delphinus longirostris* Gray subsequently proved to be a species of *Stenella* (True, 1889) and has recently been shown to be the holotype of the spinner dolphin *Stenella longirostris* (Gray, 1828) (van Bree and Perrin, 1977).

The description of *Delphinus longirostris* Cuvier, 1829 was based on a skull collected on the coast of Malabar by Dussumier. As this name was preoccupied by *Delphinus longirostris* Gray, 1828, van Bree (1971a) proposed the name *Delphinus tropicalis* for this species.

The specific status of *D. tropicalis* van Bree is not fully established at present owing to uncertainty concerning the taxonomic status of *Delphinus* populations elsewhere. However, new material described recently shows that *D. tropicalis* is an extremely long-snouted form of *Delphinus* (beak length 9–11% of total length) characterized by a long rostrum (62–70% CBL) and a greater number of teeth (53–67 in each jaw) (Pilleri and Gihr, 1972a, 1973/74) than in *D. delphis* (40–55 teeth, normally 45–53; van Bree, 1971c). The rostal length/zygomatic width ratio in *D. tropicalis* ranges from 1,89–2,03 whereas the same ratio in *D. delphis* ranges from 1,25–1,75 (Pilleri and Gihr, 1973/74; van Bree, 1971c).

TABLE 84:

Records of *Delphinus delphis* stranded or captured on the SE coast of southern Africa.

| Catalogue Number | Sex | Total length (mm) | CBL (mm) | Date | Locality | Remarks |
|---|---|---|---|---|---|---|
| ZMA*13.340 | — | — | — | — | Plettenberg Bay | van Bree and Purves (1972). |
| PEM 1517/41 | — | — | 505 | Nov. 1910 | East London | ex KM** 10818. |
| PEM 1517/43 | — | — | — | Nov. 1910 | East London | ex KM 10820. |
| PEM 1517/40 | — | — | 483 | 1928 | Kidds Beach | ex KM 18021 |
| PEM 1517/42 | — | — | 473 | Feb. 1937 | Hamburg | ex KM 10822 |
| PEM 1496/70 | — | — | — | late 1962 | Algoa Bay | Skull on exchange. |
| PEM 1496/71 | — | — | — | late 1962 | Algoa Bay | Skull on exchange. |
| PEM 1513/104 | — | — | 496 | — | Algoa Bay? | Skull in PEM |
| — | — | — | — | Oct. 1964 | Durban | 93 animals in shark nets; Anon (1965). |
| PEM 1513/105 | — | — | (505) | — | — | Skull in PEM. |
| PEM 1513/106 | — | — | — | — | — | Skull in PEM. |
| PEM 1514/32 | — |  |  | — | — | Skull in PEM. |
| PEM 1515/05 | ♀ | — | (475) | 27.10.69 | Seaview |  |
| PEM 1515/26 | — | (2 460) | 518 | 08.02.70 | nr. Gamtoos River Mouth |  |
| PEM 1515/88 | ♂ | — | 460 | 03.11.70 | Cape Receife | Decomposed carcase. |
| PEM 1515/93 | — | — | 484 | Oct. 1970 | 6 km E of Woody Cape |  |
| PEM 1515/96 | — | — | 483 | Nov. 1970 | Algoa Bay | Harpooned by fishermen. |
| PEM 1515/99 | ♂ | 1 300 | — | 21.11.70 | Port Elizabeth |  |
| — | ♀ | — | — | 04.12.70 | Bushman's River | Pregnant. Foetus *c.* 380 mm. |
| — | ♀ | — | — | 11.12.70 | Willows, P.E. | Photos in PEM. |
| PEM 1516/05 | ♀ | 2 135 | 472 | 25.12.70 | Amsterdamhoek | Stranded alive. |
| PEM 1516/11 | ♂ | 2 360 | — | 08.01.71 | Cape Receife |  |
| PEM 1516/90 | — | — | (452) | 09.04.71 | Bird Island | Isolated head found. |
| PEM 1517/24 | — | — | — | 1971 | Robbeberg | Skull found in dunes. |
| PEM 1517/39 | ♂ | 2 540 | — | *c.* Aug. 1971 | Cape St. Francis | Decomposed carcase. |
| PEM 1517/59 | ♂ | 1 765 | — | 01.12.71 | Plettenberg Bay | Cast in PEM. |
| PEM 1517/71 | ♂ | 1 020 | — | 27.02.72 | Laurie's Bay |  |
| SAM 36973 | ♂ | 2 400 | — | 06.02.73 | 32° 24′S, 28° 54′E | Collected at sea. |
| PEM 1518/76 | — | — | — | 30.10.73 | Algoa Bay | Stomach of *Carcharodon carcharias*. |
| PEM 1518/89 | — | — | 492 | Mar. 1974 | Off Elands River | Skull trawled at 80 m depth. |
| PEM 1519/00 | ♀ | — | 482 | 22.07.74 | North Coast, Natal | Shark nets with 1519/01. |
| PEM 1519/01 | ♀ | — | 493 | 22.07.74 | North Coast, Natal | Shark nets with 1519/00. |
| PEM 1519/02 | ♂ | 1 580 | — | 14.08.74 | Umhloti | Shark nets with next four specimens. |
| PEM 1519/03 | ♀ | 1 490 | — | 14.08.74 | Umhloti | As above. |
| PEM 1519/04 | ♀ | 1 350 | — | 14.08.74 | Umhloti | As above. |
| PEM 1519/05 | ♂ | 1 320 | — | 14.08.74 | Umhloti | As above. |
| PEM 1519/06 | — | — | 529 | 14.08.74 | Umhloti | Head only. As above. |
| PEM 1519/22 | ♀ | 1 590 | — | 09.03.75 | Sundays River Mouth | Stranded alive. |
| PEM 1519/63 | — | — | 479 | Mar. 1975 | Port Alfred area | Skull brought in. |
| PEM 1519/78 | ♂ | 1 830 | — | 28.07.75 | Ifafa |  |
| PEM 1519/81 | ♀ | 1 720 | — | Mid 1975 | Natal Coast |  |
| PEM 1519/83 | ♀ | 2 120 | 466 | 23.07.75 | Amanzimtoti | Shark nets. |
| PEM 1519/84 | ♀ | 2 220 | 398 | 23.07.75 | Amanzimtoti | Shark nets. |
| PEM 1519/85 | ♀ | 2 130 | 466 | 23.07.75 | Amanzimtoti | Shark nets. |

Records of *Delphinus delphis* stranded or captured on the SE coast of southern Africa.

| Catalogue Number | Sex | Total length (mm) | CBL (mm) | Date | Locality | Remarks |
|---|---|---|---|---|---|---|
| PEM 1519/94 | ♀ | 1 700 | — | 28.12.75 | Willows, P.E. | |
| PEM 1519/95 | ♀ | 1 110 | — | 04.01.76 | Cape Receife | Stranded alive. |
| PEM 1519/96 | ♂ | 2 410 | 463 | 18.01.76 | Cape Receife | Stranded alive. |
| PEM 1519/97 | ♂ | 2 500 | — | 09.02.76 | Schoenmakerskop | Stranded alive. |
| PEM 1520/23 | ♂? | 1 900 | — | 24.10.76 | Van Stadens River Mouth | Decomposing. |
| PEM 1520/41 | — | — | — | Jan. 1977 | Cape Receife | Skull on beach. |
| PEM 1520/51 | — | — | — | Mar. 1977 | Bird Island | Decomposed carcase. |
| PEM 1520/52 | — | — | 515 | 1977 | Bird Island | Bleached skull. |
| PEM 1520/53 | — | — | — | 1977 | Bird Island | Bleached skull. |
| PEM 1520/54 | — | — | 492 | 1977 | Stag Island | Decomposed carcase. |
| PEM 1520/59 | ♀ | 2 210 | — | 21.04.77 | Port Elizabeth | Stranded alive. |
| PEM 1520/69 | — | — | — | 10.09.77 | Cape Receife | Immature. Mutilated. |
| PEM 1520/90 | ♀ | 900 | — | 11.12.77 | Van Stadens River Mouth | Decomposing neonate. |
| — | — | — | — | 17.12.77 | Kasuga River Mouth | Photos in PEM. |
| PEM 1521/30 | ♂ | 1 860 | — | 26.05.78 | 33° 03'S, 27° 57'E | Floating dead at sea. |
| PEM 1521/32 | ♂ | 990 | — | 02.07.78 | Cefane | Decomposing neonate. |

( ) denotes approximate measurement.

* ZMA—Zöologish Museum, Amsterdam.

** KM—Kaffrarian Museum, King William's Town.

Skull measurements of the type of *D. capensis* Gray, 1828 were kindly taken and supplied to the author by Mr M. Sheldrick (British Museum) and are compared with those of SE coast specimens in Table 86. Sheldrick *(in litt.)* noted that this type skull was partly damaged and that as a result the condylobasal length and some other measurements could not be taken. The tooth count in the upper right jaw is incomplete and the other tooth counts exclude one or two teeth which may be buried in tissue at the tips of the jaws. Comparison between the measurements in Table 86 clearly shows that those of *D. capensis* fall within the ranges of values in

Table 85:

Sight records of *Delphinus delphis* on the SE coast of southern Africa. Data from IOS (1973), photographs in PEM files and personal observations.

| Date | Number | Locality |
|---|---|---|
| 31.12.57 | sev. 100 | 34° 00' S, 25° 52' E |
| 24.05.70 | 200–300 | 33° 59' S, 25° 42' E |
| 11.02.73 | *c.* 1000 | 34° 29' S, 26° 10' E |
| 29.06.73 | — | 31° 06' S, 30° 12' E |
| 11.10.76 | *c.* 200 | 33° 53' S, 25° 42' E |
| 08.01.77 | 500–1000 | 33° 43' S, 26° 00' E |
| 25.02.77 | *c.* 200 | 33° 54' S, 25° 40' E |
| 23.04.77 | 1000–5000 | 34° 21' S, 25° 36' E |
| 09.02.78 | *c.* 500 | 33° 59' S, 25° 42' E |

TABLE 86:
Skull measurements in mm of 21 *Delphinus delphis* from the SE coast of southern Africa, and the type of *D. capensis* Gray, 1828. Measurement numbers except No. 37 are keyed to Table 6.

| Measurement Number | PEM 1516/90 | PEM 1515/88 | PEM 1519/96 | PEM 1519/85 | PEM 1519/83 | PEM 1517/42 | PEM 1516/05 | PEM 1519/63 | PEM 1519/00 | PEM 1515/96 | PEM 1517/40 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 452** | 460* | 463 | 466 | 466 | 473 | 472 | 479 | 482 | 483 | 483 |
| 2 | 287 | 300 | 295 | 295 | 298 | 292 | 295 | 314 | 312 | 316 | 309 |
| 3 | 88 | 93 | 91 | 87 | 92 | 93 | 92 | 93 | 93 | 90 | 97 |
| 4 | 57 | 63 | 64 | 59 | 65 | 65 | 63 | 61 | 63 | 60 | 64 |
| 5 | 49 | 50 | 50 | 47 | 50 | 52 | 52 | 49 | 48 | 52 | 53 |
| 6 | 22 | 23 | 27 | 21 | 22 | 22 | 26 | 22 | 22 | 23 | 23 |
| 7 | — | 335 | 341 | 342 | 343 | 343 | 343 | 361 | 360 | 364 | 369 |
| 8 | — | 331 | 329 | — | — | 334 | 341 | 355 | 352 | 352 | 343 |
| 9 | — | 168 | 165 | 157 | 167 | 175 | 158 | 167 | 165 | 168 | 172 |
| 10 | 179 | 187 | 186 | 183 | 189 | 198 | 180 | 187 | 194 | 190 | 193 |
| 11 | 160 | 173 | 169 | 164 | 168 | 175 | 162 | 168 | 170 | 165 | 168 |
| 12 | 46 | 46 | 49 | 48 | 42 | 46 | 45 | 47 | 50 | 47 | 49 |
| 13 | 177 | 188 | 185 | 181 | 185 | 197 | 178 | 186 | 192 | 187 | 192 |
| 14 | 73 | 71 | 76 | 71 | 71 | 71 | 67 | 67 | 75 | 68 | 75 |
| 15 | 135 | 137 | 143 | 138 | 145 | 142 | 139 | 138 | 146 | 143 | 139 |
| 16 | 43+ | 44+ | 48 | 49 | 49 | 51 | 52 | 48+ | 50 | 52 | 49 |
| 17 | 44+ | 43+ | 48 | 47 | 50 | 51 | 51 | 51 | 50 | 51 | 51 |
| 18 | — | — | 250 | 246 | 251 | 250 | 250 | — | 263 | 250 | 257 |
| 19 | — | — | — | 234 | 253 | 247 | 245 | 268 | 266 | 258 | 260 |
| 20 | — | — | 250 | 249 | 255 | 253 | 253 | — | 264 | 254 | 263 |
| 21 | — | — | 247 | 247 | 255 | 253 | 250 | 272 | 267 | 262 | 264 |
| 22 | 38+ | 44+ | — | 51 | 49 | — | 51 | 47 | 47 | 50 | 47 |
| 23 | 40+ | 43+ | — | 52 | 51 | — | 51 | 47 | 47 | 49 | 47 |
| 24 | — | — | — | 247 | 243 | — | 248 | 256 | 249 | 248 | 249 |
| 25 | — | — | — | 245 | 250 | — | 245 | 256 | 245 | 248 | 253 |
| 26 | — | — | — | 248 | 244 | — | 250 | 256 | 250 | 250 | 255 |
| 27 | — | — | — | 248 | 250 | — | 247 | 258 | 246 | 250 | 257 |
| 28 | 365+ | 390+ | — | 412 | — | — | 399 | 422 | 420 | 417 | 420 |
| 29 | 65 | 68 | — | 66 | — | — | 66 | 70 | 70 | 69 | 72 |
| 30 | 41+ | 40+ | — | 59 | — | — | 59 | 70 | 66 | 58 | 57 |
| 31 | 71 | 75 | 69 | 72 | 75 | 77 | 79 | 72 | 69 | 76 | 71 |
| 32 | 54 | 53 | 61 | 54 | 62 | 58 | 56 | 56 | 49 | 57 | 53 |
| 33 | — | 38 | 40 | 34 | 35 | 39 | 38 | 37 | 37 | 38 | 44 |
| 34 | 112 | 122 | 123 | 111 | 118 | 123 | 116 | 114 | 116 | 117 | 119 |
| 35 | — | — | 32,7 | — | 32,7 | — | 33,9 | 32,4 | — | — | — |
| 36 | — | — | 32,6 | — | 32,4 | — | — | — | 33,8 | — | — |
| 37+ | 1,62 | 1,60 | 1,59 | 1,63 | 1,61 | 1,48 | 1,66 | 1,69 | 1,63 | 1,69 | 1,61 |

( ) denotes approximate measurement. * 10 mm added to rostral tip for breakage. ** 20 mm added to rostral tip for breakage.

+ Measurement No. 37 = rostral length/zygomatic width.

| PEM 1515/93 | PEM 1518/89 | PEM 1520/54 | PEM 1519/01 | PEM 1513/104 | PEM 1517/41 | PEM 1513/105 | PEM 1520/52 | PEM 1515/26 | PEM 1519/06 | type *D. capensis* |
|---|---|---|---|---|---|---|---|---|---|---|
| 484 | 492* | 492 | 493 | 496 | 505 | 505* | 515 | 518 | 529 | — |
| 317 | 317 | 326 | 320 | 317 | 331 | 326 | 336 | 334 | 347 | 325 |
| 88 | 91 | 92 | 89 | 99 | 91 | 102 | 101 | 92 | 95 | 88 |
| 57 | 61 | 62 | 61 | 72 | 61 | 72 | 65 | 67 | 66 | 62 |
| 48 | 51 | 54 | 49 | 60 | 46 | 56 | 50 | 51 | 55 | 51 |
| 23 | 24 | 25 | 23 | 27 | 23 | 26 | 26 | 23 | 24 | 23,5 |
| 368 | 363 | 378 | 378 | 375 | 382 | 381 | 391 | 383 | 399 | 370 |
| 358 | — | 368 | 357 | 357 | 373 | — | — | 379 | 394 | — |
| 166 | 178 | 167 | 168 | 178 | 160 | 177 | — | 175 | 176 | 162 |
| 189 | 198 | 188 | 191 | 202 | 176 | 200 | — | 196 | 202 | 190 |
| 167 | 182 | 168 | 170 | 177 | 159 | 177 | — | 177 | 179 | — |
| 46 | 46 | 50 | 47 | 47 | 49 | 50 | 45 | 47 | 50 | 47,5 |
| 186 | 194 | 185 | 187 | 205 | 177 | 198 | 194 | 192 | 199 | 189 |
| 70 | 74 | 73 | 72 | 69 | 72 | 71 | 73 | 72 | 74 | 72 |
| 140 | 152 | 136 | 145 | 150 | 133 | 141 | 143 | 144 | 157 | 146 |
| 56 | 41+ | 52 | 52 | 55 | 50 | 53 | 51 | 58 | 54 | 45+ |
| 54 | 41+ | 52 | 53 | 54 | 51 | 50+ | 50 | 60 | 54 | 49+ |
| 271 | — | 269 | 273 | 266 | 251 | 277 | 290 | 287 | 289 | 275+ |
| 271 | — | 277 | 270 | 266 | 252 | — | 288 | 287 | 287 | 281 |
| 273 | — | 285 | 275 | 268 | 289 | — | 291 | 292 | 293 | 278+ |
| 273 | — | 285 | 274 | 270 | 287 | — | 290 | 292 | 291 | 283 |
| 54 | — | 52 | 48 | — | 52 | — | 51 | 56 | 52 | 49(?+) |
| 54 | — | 52 | 50 | — | 54 | — | 52 | 57 | 51 | 47(?+) |
| 263 | — | 264 | 258 | — | 269 | — | 280 | 276 | 275 | 266 |
| 261 | — | 272 | 258 | — | 271 | — | 280 | 280 | 271 | 252(?+) |
| 265 | — | 264 | 258 | — | 273 | — | 281 | 280 | 278 | 272 |
| 264 | — | 273 | 258 | — | 273 | — | 282 | 284 | 274 | 266 |
| 420 | — | 428 | 431 | — | 432 | — | 467 | 451 | 450 | 433 |
| 68 | — | 71 | 66 | — | 66 | — | 72 | 70 | 72 | 71,5 |
| 64 | — | 67 | 60 | — | 66 | — | 75 | 71 | 73 | 61 |
| 75 | 73 | 67 | 76 | 72 | 77 | — | 70 | 79 | 76 | 69 |
| 51 | 54 | 56 | 58 | 62 | 56 | — | 54 | 61 | 63 | 53 |
| 33 | 40 | 39 | (41) | 46 | 31 | — | 41 | 42 | 42 | 36 |
| 113 | 130 | 114 | 116 | 130 | 118 | 120 | 118 | 133 | 130 | 155 |
| — | — | 32,9 | 34,1 | — | — | — | — | — | — | — |
| 31,9 | — | 33,0 | 34,4 | — | — | — | — | — | — | 33,5 |
| 1,70 | 1,63 | 1,76 | 1,71 | 1,55 | 1,87 | 1,65 | 1,73 | 1,74 | 1,74 | 1,72 |

other specimens of *Delphinus* from southern African waters and that all of these specimens can be considered conspecific.

Very few detailed skull measurements of nominate *D. delphis* from the North Atlantic appear to have been published, limiting the data available to six specimens. Using the U-test Mann-Whitney (Campbell, 1967), the means and ranges of measurements from these six skulls are compared with those in Table 87 of 21 specimens from the SE coast. These measurements suggest that specimens from the SE coast tend to have narrower skulls with slightly longer rostra. However, this conclusion is dependent upon the variation shown by the very small sample of North Atlantic specimens. Thus van Bree (1971c) noted that the number of teeth in *D. delphis* ranges from 40–55, which is considerably greater than that in the present sample of North Atlantic animals.

The ratio of rostral length to zygomatic width in *D. delphis* from the western North Atlantic ranged from 1,37–1,54 in 16 skulls measured by van Bree and Purves (1972) whereas the same ratio in 17 skulls from the coast of West Africa ranged from 1,46–1,79. In the southern African material this ratio ranged from 1,48–1,87 (Table 85, meas. 37). Comparison of these values suggests that, unless two or more species of *Delphinus* are present in the North Atlantic, the southern African population reported on here should be considered conspecific with *D. delphis* Linnaeus.

Similar variation in skull proportions occurs in the eastern Pacific. Banks and Brownell

TABLE 87:

Comparison of skull measurements (as percentages of CBL) of *Delphinus* from the SE coast of southern Africa and *Delphinus delphis* from the North Atlantic. Data are taken from Table 85, True (1889) and Pilleri and Gihr (1972a). Condylobasal length is given in mm. Measurement numbers are keyed to Table 6.

| Measurement Number | North Atlantic *D. delphis* | | | Southern African *Delphinus* | | | U-Values |
|---|---|---|---|---|---|---|---|
| | $\bar{x}$ | Range | N | $\bar{x}$ | Range | N | |
| 1 | 454 | 419–480 | 6 | 486 | 452–529 | 21 | 19 |
| 2 | 62,4 | 60,4–70,8 | 6 | 64,5 | 61,7–66,3 | 21 | 21 |
| 3 | 20,1 | 19,4–20,8 | 6 | 19,1 | 17,8–20,2 | 21 | 26 |
| 5 | 11,7 | 10,4–13,2 | 6 | 10,5 | 9,1–12,1 | 21 | 15** |
| 6 | 5,1 | 4,9– 5,3 | 4 | 4,9 | 4,4–5,8 | 21 | 22 |
| 7 | 71,6 | 70,2–74,0 | 6 | 74,7 | 70,7–76,8 | 20 | 18 |
| 8 | 70,8 | 69,2–72,4 | 2 | 72,6 | 69,8–74,8 | 15 | 6,5 |
| 9 | 37,7 | 37,3–38,1 | 2 | 34,7 | 31,7–37,0 | 19 | 0*** |
| 10 | 41,4 | 40,6–42,1 | 2 | 39,3 | 34,7–41,9 | 20 | 3,5 |
| 11 | 37,3 | 36,6–38,9 | 4 | 35,5 | 31,5–37,7 | 20 | 6** |
| 13 | 41,2 | 40,4–41,9 | 2 | 38,9 | 37,1–41,6 | 21 | 3 |
| 14 | 16,6 | 15,8–17,5 | 6 | 14,8 | 13,9–16,2 | 21 | 4,5*** |
| 15 | 32,3 | 30,8–33,8 | 6 | 29,3 | 26,3–31,1 | 21 | 4*** |
| 16 | 48,6 | 48–50 | 5 | 51,8 | 48–58 | 17 | 17 |
| 17 | 48,7 | 48–50 | 6 | 51,6 | 47–60 | 17 | 12** |
| 18 | 51,7 | 49,9–54,2 | 6 | 53,9 | 49,7–56,3 | 17 | 16 |
| 22 | 48,3 | 47–50 | 4 | 50,5 | 47–56 | 14 | 14 |
| 23 | 48,0 | 47–49 | 4 | 51,0 | 47–57 | 14 | 11 |
| 28 | 86,6 | 84,7–87,7 | 3 | 87,0 | 84,5–90,7 | 13 | 15 |
| 29 | 15,2 | 14,7–15,8 | 4 | 14,1 | 13,1–14,9 | 14 | 2 |
| 30 | 11,5 | 10,4–12,5 | 2 | 13,2 | 11,8–14,6 | 13 | 3,5 |
| 31 | 15,2 | 13,5–16,5 | 6 | 15,1 | 13,6–16,7 | 20 | 57 |
| 32 | 11,5 | 10,4–12,2 | 6 | 11,6 | 10,2–13,3 | 20 | 70 |

** significant at $\alpha = 0{,}02$
*** significant at $\alpha = 0{,}002$

(1969) found that *Delphinus* from the Pacific coast of North America could be separated into two groups on the ratio between rostral length and zygomatic width. Those specimens with ratios of 1,53 or less were referred to *D. delphis* where as those with ratios of 1,55 or more were referred to *D. bairdii* Dall, 1873. Their conclusions were criticized by van Bree and Purves (1972) who pointed out the variation in the ratios of Atlantic specimens and others from New Zealand, and that such variation could occur with in the same region, indicating sympatry if two species were involved. The problem has been largely resolved by Evans (1976) who showed that four stocks of *Delphinus* could be distinguished on the west coast of North America: a long-snouted stock with rostal length/zygomatic width ratios of 1,52–1,74 confined to the Gulf of California and coastal waters of southern California inside the 200 m depth contour, and three short-snouted stocks with ratios of 1,49 or less occurring between latitudes of 28°–30° N, north of 32°N, and south of 15°N. Short-snouted forms occurred offshore but also occurred in the Gulf of California and in the coastal waters of southern California though never in association with long-snouted forms. Evans (1976) suggested that more detailed study may show that the long-snouted neritic form may warrant at least sub-specific status but that changes in present nomenclature would be premature.

It is interesting to note that the range of rostral length/zygomatic ratios of the SE coast specimens (Table 86) closely matches that of the long-snouted neritic form described by Evans (1976) and that *D. delphis* also appears to have a neritic distribution along the SE coast of southern Africa (discussed under Distribution). It is possible that long-snoutedness is a modification associated with aspects of a neritic existence.

### DESCRIPTION

A 2,21 m adult female PEM 1520/59 is illustrated in Fig. 23.

The body is slender and streamlined, slightly compressed laterally anterior to the dorsal fin, becoming strongly compressed towards the flukes. The head tapers evenly anteriorly, forming a long, narrow beak (6,6–7,9% of total length). The melon is small and moderately depressed. In dorsal view it tapers to a distinct acute apex and laterally forms a distrinct angle at its junction with the beak. The flippers are moderate in length (14,0–16,5% of total length in specimens over 1,5 m long), tapering to a pointed apex; the leading edge is convex and the trailing edge is falcate. The dorsal fin is prominent and falcate with a straight leading edge; it is about 10% of body length in height (range 7,7–11,4% of body length) and is set at mid-length of the body. The flukes are of moderate width (18,5–24,5% of total length), and crescentic in dorsal view, tapering distally to a rounded apex.

External measurements of 15 specimens selected by length between 0,9 and 2,5 m are given in Table 88.

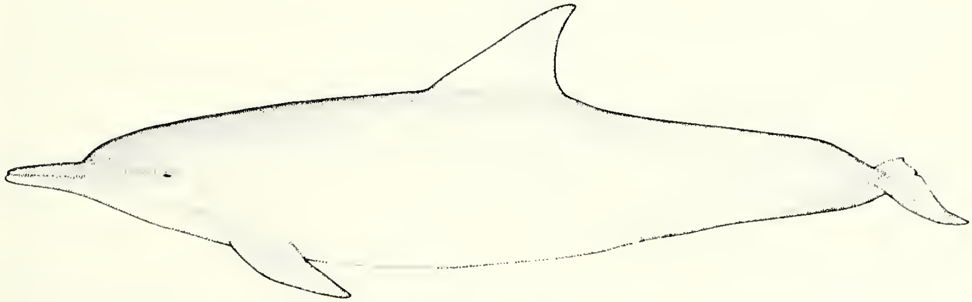


Fig. 23. Adult female *Delphinus delphis*, 2,21 m in length, from the eastern Cape (PEM 1520/59).

TABLE 88:

External measurements in mm of 15 *Delphinus delphis* from the SE coast of southern Africa. Measurement numbers are keyed to Table 2.

| Meas. No. | PEM 1520/90 ♀ | PEM 1519/95 ♀ | PEM 1515/99 ♂ | PEM 1519/03 ♀ | PEM 1519/22 ♀ | PEM 1519/94 ♀ | PEM 1521/30 ♂ | PEM 1516/05 ♀ | PEM 1519/85 ♀ | PEM 1520/59 ♀ | PEM 1519/84 ♀ | PEM 1516/11 ♂ | SAM 36973 ♂ | PEM 1519/96 ♂ | PEM 1519/97 ♂ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 900 | 1 110 | 1 300 | 1 490 | 1 590 | 1 700 | 1 860 | 2 135 | 2 130 | 2 210 | 2 220 | 2 360 | 2 400 | 2 410 | 2 500 |
| 2 | 180 | 220 | 260 | 255 | 280 | 300 | 325 | 380 | 350 | 380 | 360 | 390 | 370 | 360 | 410 |
| 3 | 65 | 85 | 100 | 108 | 125 | 120 | 138 | 160 | 165 | 175 | 175 | 180 | 180 | 158 | 180 |
| 4 | 125 | 185 | 215 | 215 | 245 | 245 | 280 | 318 | 300 | 325 | 310 | 340 | 312 | 300 | 340 |
| 5 | — | 257 | 300 | 270 | 360 | 350 | 390 | 430 | 405 | 445 | 420 | 450 | 410 | 410 | 465 |
| 6 | — | 37 | 40 | — | 55 | 32 | 55 | 57 | 55 | 65 | 55 | 60 | 56 | 60 | 65 |
| 7 | — | 35 | 50 | 45 | 50 | 60 | 50 | 57 | 60 | 60 | 55 | 50 | 60 | 50 | 60 |
| 8 | — | 110 | 120 | 150 | 160 | 160 | 170 | 150 | 175 | 165 | 180 | 170 | 186 | 200 | 190 |
| 9 | 175 | 220 | 270 | 260 | 305 | 320 | 350 | 395 | 380 | 395 | 400 | 410 | 380 | 350 | 430 |
| 10 | 250 | 310 | 360 | 350 | 390 | 400 | 420 | 520 | 480 | 520 | 500 | 560 | 535 | 520 | 540 |
| 11 | 460 | 530 | — | 670 | 745 | 780 | 830 | — | 930 | 1 020 | 990 | — | 995 | 1 050 | 1 090 |
| 12 | 590 | 720 | 860 | 870 | 990 | 1 000 | 1 110 | 1 370 | 1 260 | 1 360 | 1 320 | 1 460 | 1 400 | 1 390 | 1 460 |
| 13 | 470 | 580 | 650 | 740 | 750 | — | 870 | — | — | — | — | 1 180 | 1 090 | 1 040 | — |
| 14 | 720 | 770 | 850 | 1 010 | 1 070 | — | 1 210 | 1 500 | 1 440 | 1 600 | 1 510 | 1 630 | 1 550 | 1 500 | 1 650 |
| 15 | — | 810 | 950 | 1 060 | — | 1 200 | 1 350 | 1 575 | — | — | — | 1 800 | 1 770 | 1 730 | 1 860 |
| 16 | — | 5 | 5 | 5 | 3 | 8 | 7 | 6 | 8 | 10 | 3 | 10 | 9 | 30 | 10 |
| 20 | — | 540 | 720 | 740 | 760 | 920 | 930 | 1 090 | — | 1 010 | — | 1 140 | 1 160 | 1 080 | — |
| 21 | — | 580* | 720 | 760* | 775* | 960** | 990* | 1 170 | — | 1 150* | — | 1 230* | 1 240 | 1 160 | — |
| 22 | — | 320 | 340 | 440 | 410 | 500 | 550 | 585 | — | 620 | 640 | 780 | 725 | 720 | 820 |
| 23 | — | 17 | 17 | 18 | 23 | 23 | 24 | 25 | 26 | 25 | 25 | 20 | 21 | 25 | 25 |
| 24 a | — | 12 | — | 15 | 15 | 12 | — | 19 | 13 | 25 | 22 | — | — | — | — |
| b | — | 12 | — | 15 | 10 | 12 | — | 19 | 13 | 25 | 18 | — | — | — | — |
| 25 a | — | 165 | 42 | — | — | — | 90 | 145 | — | — | — | 70 | 130 | 110 | 80 |
| b | — | 20 | — | — | — | — | 20 | 16 | — | — | — | — | 45 | 40 | 15 |
| c | — | — | — | 100 | 100 | 110 | — | — | 110 | 180 | 125 | — | — | — | — |
| 26 | — | 18 | 17 | 18 | 22 | 23 | 25 | 25 | 25 | 28 | 23 | 25 | 24 | 34 | 25 |
| 27 | 180 | 220 | 230 | 215 | 260 | 250 | 295 | 318 | 315 | 355 | 330 | 350 | 355 | 360 | 370 |
| 28 | 120 | 150 | 160 | 145 | 180 | 180 | 215 | 240 | 240 | 255 | 230 | 250 | 260 | 250 | 265 |
| 29 | 52 | 80 | 75 | 70 | 85 | 83 | 100 | 108 | 100 | 120 | 105 | 120 | 117 | 115 | 115 |
| 30 | 70 | 115 | 130 | 115 | 150 | 135 | 175 | 240 | 210 | 245 | 190 | 270 | 240 | 245 | 290 |
| 31 | 75 | 200 | 220 | 220 | 240 | 240 | 280 | 405 | 360 | 350 | 340 | 440 | 400 | 350 | 430 |
| 32 | (160) | 245 | 270 | 275 | 310 | 325 | 410 | 485 | 460 | 535 | 420 | 580 | 530 | 500 | 600 |
| 33 | 60 | 90 | 100 | 92 | 115 | 110 | 128 | 152 | 140 | 150 | 130 | 160 | 152 | — | 160 |
| 34 | 15 | 20 | 20 | 12 | 28 | 20 | 25 | 29 | 25 | 30 | 20 | 30 | 25 | 30 | 30 |

( ) denotes approximate measurement; * at anterior insertion of dorsal fin; ** at umbilicus

The characteristic colour pattern of *Delphinus* has been described by some authors (Mitchell, 1970; Perrin, 1972) as criss-cross, referring to the lateral view in which a figure of eight is formed by the buff or brownish grey thoracic patch between the eye and midlength of the body and the pale grey flank patch extending from midlength of the body over most of the caudal peduncle (Fig. 23). A dark grey or black flipper stripe connects the insertion of the flipper with a point on the lower jaw about two-thirds the length of the gape from the tip of the rostrum. A primary body stripe begins at the angle of the gape and runs posteriorly to the midventral line, caudal to the anal opening. The anterior two-thirds of this stripe is usually buff or buffish grey in colour and is not strongly contrasted with the white ventral surface. The posterior third is dark grey in colour and more prominent.

Accessory stripes are often present. In all 17 specimens examined a narrow posterior accessory stripe, dark grey in colour, underlined the posterior half of the primary body stripe, and in two specimens they joined anteriorly. An anterior accessory stripe normally faint and buff or buffish grey in colour, branched from the primary stripe between the eye and the flipper insertion and ran ventral to the primary stripe to about the level of the flipper tip. This stripe was present in 12 of 14 specimens examined. An antero-dorsal branch of the primary stripe may be present (eight of 11 specimens examined) and extends as an indistinct greyish streak into the posterior third of the thoracic patch. Finally a narrow greyish stripe is often present (11 of 13 specimens) on the ventral surface mesial to each flipper and runs anteriorly ventral to the flipper stripe.

The dorsal surface and the appendages are normally black or greyish black. Occasionally (two of 13 specimens) the internal and external surfaces of the flippers may be brownish in colour distal to the insertion. A whitish or pale brown blaze may be present on the dorsal fin (three of 15 specimens). The proportion of animals with white fin blazes was estimated at 20–30%, 30% and 30% for three schools of *Delphinus* sighted at sea in or close to Algoa Bay on 8 January 1977, 23 April 1977 and 9 February 1978 (Table 85).

The rostrum of the skull is long (61,7–66,3% CBL, n = 21) and narrow. The width of the rostrum at its base is 27–32% of its length and at its midlength is 14–19% of its length. The ventral surface of each maxilla on the palate is deeply grooved in the posterior two-thirds of the rostrum with the result that laterally the rostrum becomes extremely thin in this region. The structural strength of the rostrum in its proximal half is provided by the mesial portion of each maxilla and the vomer which form a well-developed ridge ventrally, and the premaxillae which are raised dorsally to form a strong ridge and which are fused in the dorsal midline in this region in skulls of adults and subadults. The cranium is comparatively small and narrow; the zygomatic width varies from 37,1–41,6% CBL. The number of teeth in the upper and lower jaws respectively varies from 47–60 and 47–57, with means of 51,7 and 50,8 respectively.

Skull measurements for 21 *D. delphis* from the SE coast are given in Table 86.

Details of the vertebral formulae of 11 specimens from the SE coast are presented in Table 89. The limits of variation are C7 T14–17 L18–23 Cd29–34 = 72–76, and the most usual formula is C7 T15 L21 Cd31 = 74. An additional specimen, PEM 1519/05, had only 13 ribs.

## BIOLOGY

*Age determination:* Teeth from 21 *D. delphis* were available for estimating age. Those from one neonatal animal and four juveniles were examined as polished half teeth. The remainder were viewed as ground longitudinal sections in water using transmitted light. Counts of dentine growth layers are given in Table 90.

Growth layers could not be counted beyond 11 or 12 layers in most older specimens, when the pulp cavity becomes occluded, usually by a small amount of secondary dentine. Variation in a comparison of time of death with the appearance of the innermost dentine zone in nine teeth was too great to suggest whether opaque and translucent zones alternated seasonally.

TABLE 89:

Vertebral data for 11 *Delphinus delphis* from the SE coast of southern Africa.

| Catalogue Number | Number of Vertebrae | | | | |
|---|---|---|---|---|---|
| | Cervical | Thoracic | Lumbar | Caudal | Total |
| PEM 1519/02 | 7 | 17 | 18 | 33 (+1) | 75 (+1) |
| PEM 1519/78 | 7 | 15 | 21 | 30 | 73 |
| PEM 1519/81 | 7 | 15 | 21 | 31 | 74 |
| PEM 1519/83 | 7 | 14 | 20 | 34 | 75 |
| PEM 1519/85 | 7 | 15 | 20 | 34 | 76 |
| PEM 1519/95 | 7 | 15 | 23 | 30 | 75 |
| PEM 1519/96 | 7 | 15 | 21 | 27 (+2) | 70 (+2) |
| PEM 1519/97 | 7 | 14 | 53 | | 74 |
| PEM 1520/23 | 7 | 15 | 21 | 33 | 76 |
| PEM 1520/59 | 7 | 15 | 19 | 31 | 72 |
| PEM 1521/30 | 7 | 15 | 22 | 30 | 74 |

( ) denotes estimated number of missing vertebrae.

TABLE 90:

Counts of dentine growth layers for 21 *Delphinus delphis* from the SE coast of southern Africa. Measurements of postnatal dentine thickness were made close to the apex of the pulp cavity.

| Catalogue Number | Total length (mm) | No. of growth layers | Remarks |
|---|---|---|---|
| PEM 1515/26 | (2 460) | 11+ | Closed pulp cavity. |
| PEM 1515/93 | — | 11 | Pulp cavity slightly open. |
| PEM 1515/96 | — | 11+ | Pulp cavity closed. Some secondary dentine. Layer: 1 = 0,60 mm. |
| PEM 1516/11 | 2 360 | 11+ | Pulp cavity closed by secondary dentine. Layer: 1 = 0,40 mm. |
| PEM 1517/59 | 1 765 | < 1 | Postnatal dentine 0,30 mm. |
| PEM 1517/71 | 1 020 | 0 | Neonatal. No postnatal deposition. |
| PEM 1519/01 | — | 10 | Pulp cavity slightly open. Layer: 1 = 0,50 mm. Physically mature. |
| PEM 1519/02 | 1 580 | < 1 | Postnatal dentine 0,40 mm. |
| PEM 1519/03 | 1 490 | < 1 | Postnatal dentine 0,20 mm. |
| PEM 1519/04 | 1 350 | < 1 | Postnatal dentine 0,15 mm. |
| PEM 1519/63 | — | 6+ | Unreadable beyond 6 layers. Secondary dentine filling pulp cavity. |
| PEM 1519/81 | 1 720 | < 1 | Postnatal dentine 0,21 mm. |
| PEM 1519/85 | 2 130 | 8 | Layer: 1 = 0,35 mm. |
| PEM 1519/94 | 1 700 | 1 | Complete layer. Layer: 1 = 0,45 mm. |
| PEM 1519/95 | 1 110 | 0 | Neonatal. No postnatal deposition. |
| PEM 1519/96 | 2 410 | 12 | Pulp cavity slightly open. |
| PEM 1520/23 | 1 900 | 1,5 | Layer: 1 = 0,40 mm. |
| PEM 1520/52 | — | 12+ | Secondary dentine filling pulp cavity. |
| PEM 1520/54 | — | 14+ | Secondary dentine filling pulp cavity. Physically mature. |
| PEM 1520/69 | — | < 1 | Postnatal dentine 0,28 mm. |
| —* | — | 11+ | Secondary dentine filling pulp cavity. |

* Bushman's River, 4th December, 1970.

There is considerable variation in the thickness of the first growth layer, from 0,35–0,60 mm (mean 0,45 mm) in teeth from six adult specimens. This variation is also reflected in specimens with less than one layer deposited in the teeth, when the thickness of the postnatal dentine is compared to body length.

*Growth and development:* The lengths of four neonatal animals ranged from 0,90–1,110 m with a mean of 1,005 m (Table 84); the two largest animals were alive when they stranded. The lengths of two neonates stranded in England were similar (0,840 m; 1,067 m; Fraser, 1953, 1974). In the Black Sea, where this species attains a maximum length of only 2,19 m and averages 1,6 m, the length at birth is smaller (0,08–0,90 m; Tomilin, 1957).

Obligate nursing appears to cease at a length of about 1,5 m. The stomachs of three juveniles (lengths 1,32 m, 1,35 m and 1,58 m) contained only milk; the stomach of a juvenile 1,49 m in length contained milk and fish remains. Five other specimens 1,70–1,90 m in length contained solid food remains.

Four physically mature specimens were examined: PEM 1519/00, 1519/01, 1520/54 and 1519/83; the body length only of the last animal, a female 2,12 m in length, was measured directly. The flukes of two females, PEM 1519/00 and 1519/01 had been removed before examination and their respective total lengths were estimated at 2,25 m and 2,30 m from average measurements of tip of snout to the anterior insertion of fin, tip of fin and anal opening for eight specimens over 2,0 m in length provided in Table 88. The longest specimen recorded in this study was a 2,54 m male, PEM 1517/39, while the longest measured female PEM 1519/54 was 2,22 m in length. The lengths of five males and five females over 2,0 m in length ranged from 2,36–2,54 m and 2,13–2,22 m respectively suggesting that this species may be sexually dimorphic with respect to body length in this region.

Total and partial body masses for 21 *D. delphis* from the SE coast are provided in Table 91. Eight of these specimens were caught in shark nets or captured at sea and are considered to be normal in mass. A regression of mass on length calculated by the method of least squares for these eight specimens and two neonatal animals (1,02 m and 1,11 m in length) gave the following relationship:

$$Y = 1{,}7881 \times 10^{-8}.\ X^{2{,}9292}\ (r = 0{,}993)$$

where Y = body mass (kg) and X = body length (mm).

A similar regression calculated for 21 specimens from the Mediterranean (Gihr and Pilleri, 1969) gave the equation:

$$Y = 7{,}8617 \times 10^{-7}.\ X^{2{,}4155}\ (r = 0{,}94)$$

Comparison of the two regression coefficients using the *t*-test showed that the southern African specimens were significantly heavier ($t = 2{,}173$, $df = 27$, $\alpha = 0{,}05$) per unit length than those from the Mediterranean. Gihr and Pilleri (1969) showed a similar difference between their specimens and those from the Western North Atlantic described by Aloncle (1964, 1968). The regression coefficient for the Atlantic specimens (2,9117) is very close to that calculated from the southern African specimens.

*Reproduction:* Ovarian data for 12 *D. delphis* from the SE coast are provided in Table 92. In addition the ovaries of PEM 1516/05, 2,135 m in length, contained several corpora albicantia and a corpus luteum in the left ovary. The left ovary of the lactating, pregnant female, PEM 1520/59, 2,21 m in length, contained a large corpus luteum.

The available data suggest that female *D. delphis* attain sexual maturity at about 2,1–2,2 m in length. The age at which maturity is reached is not known, though PEM 1519/85, with eight layers in its teeth, may be considered from the appearance of the ovaries to have been approaching maturity.

In other regions the length of females at sexual maturity varies considerably. In British waters the lengths of two immature females were 1,83 m and 1,94 m and two lactating females were 2,095 m and *c.*2,29 m long (Fraser, 1946, 1953). A pregnant female, 1,99 m in length

TABLE 91:

Total mass (kg), partial body mass and intestine length (m) for 21 *Delphinus delphis* from the SE coast of southern Africa. Partial body mass is expressed as a percentage of total mass.

| Catalogue Number | Total length (mm) | Total mass (kg) | Blubber | Meat | Heart, lungs and trachea | Heart | Liver | Kidneys | Intestine length | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| PEM 1515/99 | 1 300 | 24,5 | 24,1 | 21,1 | — | 0,62 | 4,63 | 1,20 | — | Stranded. |
| PEM 1516/05 | 2 135 | 94,8 | 13,2 | 27,3 | 4,4 | 0,96 | 3,44 | 1,34 | — | Stranded. |
| PEM 1517/59 | 1 765 | 47,2 | — | — | — | — | — | — | — | Stranded. |
| PEM 1517/71 | 1 067 | 12,0 | — | — | — | — | — | — | — | Stranded. |
| PEM 1519/02 | 1 580 | 42,2 | 24,2 | 30,1 | — | — | — | — | — | Shark nets. |
| PEM 1519/03 | 1 490 | 33,8 | 21,5 | 32,9 | — | — | — | — | — | Shark nets. |
| PEM 1519/04* | 1 350 | 29,9 | 22,7 | 31,8 | — | — | — | — | 18,7 | Shark nets. |
| PEM 1519/05 | 1 320 | 29,0 | 25,0 | 28,9 | — | — | — | — | — | Shark nets. |
| PEM 1519/22 | 1 590 | 36,3 | 12,5 | — | — | — | — | — | — | Stranded alive. |
| PEM 1519/78 | 1 830 | 64,9 | 17,7 | 38,3 | — | — | — | — | — | Shark nets (?) |
| PEM 1519/81 | 1 720 | 49,9 | 19,1 | 33,6 | — | — | — | — | — | Shark nets (?) |
| PEM 1519/83 | 2 120 | 103,0 | 15,0 | 38,3 | — | — | — | — | — | Shark nets. |
| PEM 1519/84 | 2 220 | 97,5 | 15,3 | 37,6 | — | — | — | — | — | Shark nets. |
| PEM 1519/85 | 2 130 | 92,1 | 15,8 | 36,5 | — | — | — | — | — | Shark nets. |
| PEM 1519/94 | 1 700 | 55,4 | — | — | — | — | — | — | — | Stranded. |
| PEM 1519/95 | 1 110 | 13,9 | 20,4 | 24,9 | — | — | — | — | — | Stranded. |
| PEM 1519/96 | 2 410 | 102,5 | 18,4 | 42,7 | — | — | — | — | — | Stranded. |
| PEM 1519/97 | 2 500 | 163,3 | — | — | — | — | — | — | — | Stranded. |
| PEM 1520/59 | 2 210 | 112,4 | 12,6 | 34,0 | 5,16 | 0,67 | — | — | 25,5 | Stranded. |
| PEM 1521/30 | 1 860 | — | — | — | — | — | — | — | 18,7 | Dead at sea. |
| SAM 36973 | 2 400 | 159,8 | 15,3 | 35,7 | 2,83 | 0,46 | 2,17 | 0,67** | — | Captured at sea. |

* Thymus mass 75 g.
** Uncertain whether both kidneys included.

TABLE 92:

Ovarian data for 12 *Delphinus delphis* from the SE coast of southern Africa.

| Catalogue Number | Total length (mm) | No. of dentine layers | Ovarian | | Corpus luteum dimensions (mm) | Corpora albicantia diameter (mm) and indices | Total no. of corpora | Comments |
|---|---|---|---|---|---|---|---|---|
| | | | Dimensions (mm) | Mass (g) | | | | |
| PEM 1519/95 | 1 110 | 0 | 23 × 8 × 7 | 0,6 | 0 | 0 | 0 | Immature |
| | | | 21 × 10 × 6 | 0,5 | 0 | 0 | | |
| PEM 1519/04 | 1 350 | <1 | 30 × 7 (R) | — | 0 | 0 | 0 | Immature |
| | | | 33 × 9 (L) | — | 0 | 0 | | |
| PEM 1519/03 | 1 490 | <1 | 20 × 8 × 8 | 0,6 | 0 | 0 | 0 | Immature |
| | | | 20 × 9 × 6 | 0,7 | 0 | 0 | | |
| PEM 1519/22 | 1 590 | — | 20 × 10 × 4 | 0,6 | 0 | 0 | 0 | Immature |
| | | | 24 × 10 × 6 | 0,7 | 0 | 0 | | |
| PEM 1519/94 | 1 700 | 1 | 30 × 12 × 7 | 1,8 | 0 | 0 | 0 | Numerous tiny follicles. |
| | | | 31 × 11 × 8 | 1,7 | 0 | 0 | | Immature |
| PEM 1519/81 | 1 720 | <1 | 22 × 8 × 5 | 0,7 | 0 | 0 | 0 | Immature |
| | | | 22 × 10 × 5 | 0,9 | 0 | 0 | | |
| PEM 1519/83 | 2 120 | — | 39 × 18 × 11 | 5,6 | 0 | 8(288); 6(90);<br>6(90); 5(75);<br>5(60); 5(60);<br>5(10); 3(9). | 9 | Numerous follicles up to 3 mm diamter |
| | | | 34 × 17 × 15 | 4,8 | 0 | 6(216) | | |
| PEM 1519/85 | 2 130 | 8 | 39 × 18 × 16 | 7,1 | 0 | 0 | 0 | Several follicles up to 3 mm diameter |
| | | | 39 × 16 × 11 | 3,9 | 0 | 0 | | |
| PEM 1519/84 | 2 220 | — | 34 × 18 × 6 | 2,4 | 0 | 0 | 0 | Immature |
| | | | 33 × 13 × 10 | 2,3 | 0 | 0 | | |
| PEM 1519/00 | (2 250) | — | 31 × 12 × 18 (R) | 2,1 | 0 | 0 | 7 | Pregnant. Foetus 85 mm ♀. |
| | | | 35 × 42 × 19 (L) | 14,5 | 28 × 24 × 17 | 9(504; 6(96);<br>6(72); 4(48);<br>4(36); 3(4,5). | | Corpus luteum 14,5 g, centre filled with tert. liquor folliculi |
| PEM 1519/01 | (2 300) | 10 | 33 × 14 × 9 | 2,4 | 0 | 0 | 6 | Numerous follicles up to 0,5 diameter. |
| | | | 42 × 21 × 13 | 6,5 | 0 | 9(432); 7(105);<br>6(96); 4(64);<br>5(45); 3(27). | | Several follicles up to 1 mm diameter |
| PEM 1515/05 | — | — | 26 × 14 × 7 | 1,6 | 0 | 0 | 7 | Few follicles up to 0,5 mm. |
| | | | 36 × 21 × 16 | 4,8 | 0 | 7(210); 7(21);<br>7(158); 6(120);<br>5(30); 4(30). | 0 | Few tiny follicles |

(  ) denotes estimated length.

stranded on the Atlantic coast of France (Duguy, 1978) and a lactating female, 2,18 m in length, was collected off the coast of Nova Scotia (Sergeant and Fisher, 1957). These few data suggest that North Atlantic females attain sexual maturity at a similar length to southern African specimens. In Californian waters the length at sexual maturity is smaller (1,75 m–1,90 m; Harrison *et al.*, 1972) and females in the Black Sea are sexually mature at lengths of 1,55 m –1,70 m (Tomilin, 1957).

Three foetuses recorded in the present study had lengths of *c.*38 mm (male, April), 85 mm (female, July) and *c.*380 mm (sex unknown, December). Three of the dolphins caught in the shark nets off Durban in October 1964 were pregnant (Anon., 1965), and a preserved foetus at the ORI measures 432 mm.

One neonatal animal was recorded for each month from December through February, and for June. These limited data suggest that calving may occur throughout the year, perhaps with a peak in the summer months. In British waters *D. delphis* are born in late summer (Fraser, 1974), and in the Black Sea, they are born between May and November, reaching peak numbers in July (Tomilin, 1957). In Californian waters births have been recorded between January and May (Harrison *et al.*, 1972) and in March and September (Evans, 1976). Evans suggested that there may be two peaks in calving activity in this region, in spring and autumn.

Only one lactating female, PEM 1520/59, was examined. The left and right mammary glands of this animal measured 320 × 70 × 20 mm and 310 × 70 × 20 mm and had a mass of 290 g and 280 g respectively. Approximately 15 ml of milk was collected by cannulation and deep frozen at −12° C prior to analysis. This sample contained 57,7% water, 42,3% total solids (Gravimetric method), 11,3% protein (Kjeldahl method), 29,2% fat (ether extraction), 0,37% ash (muffle furnace) and 1,41% carbohydrate (by difference). The fat content of this milk is comparable to that of the milk of eight *Stenella attenuata* and one *S. longirostris* analysed by Pilson and Waller (1970) and is higher than that of three *Tursiops truncatus* and one *Stenella plagiodon* (Eichelberger *et al.*, 1940) but is much lower than values reported by Tomilin (1957) for *D. delphis* from the Black Sea, in which the fat content was 41,6–43,7%. Pilson and Waller (1970) pointed out that the fat content of bovine milk may vary within a single milking, and changes may also occur through the course of lactation, so that more samples are required before adequate comparisons can be made between different species or populations of delphinids.

The mammary glands of three sexually mature non-lactating females measured 290 × 85 ×30 mm, 290 mm and 320 × 80 × 35 mm. One mammary gland in a sexually immature female measured 310 × 50 × 10 mm.

Data on the testes of 10 males are given in Table 93. The length at sexual maturity cannot be determined from this sample, though males of less than 1,9 m in length were immature; PEM 1519/96, 2,41 m in length and with 12 dentine layers, appears to have been maturing and two other males 2,36 m and 2,4 m are clearly functionally mature. In the Black Sea males of less than 1,65 m in length were sexually immature (Tomilin, 1957). In Californian waters immature males were recorded up to 2,13 m and mature males from 1,87 m in length (Harrison *et al.*, 1972).

*Food and feeding:* Stomachs of 25 specimens were examined. Four of these were empty.

TABLE 93:

Reproductive data for 10 male *Delphinus delphis* from the SE coast of southern Africa

| Catalogue Number | Total length (mm) | No. of dentine layers | Size of testis (mm) |  | Mass of testis (g) |  |  | Diameter of tubules (μ) | Comments |
|---|---|---|---|---|---|---|---|---|---|
|  |  |  | Left | Right | Left | Right | Total |  |  |
| PEM 1517/71 | 1 067 | 0 | *50 × 6 | — | 1,4 | — | — | 24 | Neonate |
| PEM 1515/99 | 1 300 | — | 55 × 12 | 52 × 12 | 3,6 | 3,5 | 7,1 | 49 | Immature |
| PEM 1519/02 | 1 580 | <1 | *63 × 8 | 58 × 8 | 6,3 | 5,8 | 12,1 | 33 | Immature |
| PEM 1517/59 | 1 765 | <1 | 85 × 13 | 80 × 13 | 13 | 11 | 24 | — | Immature |
| PEM 1519/78 | 1 830 | — | *75 × 18 | 85 × 18 | 9,7 | 10,5 | 20,2 | — | Tissue macerated |
| PEM 1521/30 | 1 860 | — | *65 × 15 | 65 × 15 | 8,2 | 8,6 | 16,8 | 30 | Immature |
| PEM 1516/11 | 2 360 | 11+ | 460 × 140 | 530 × 140 | 3855 | 4085 | 7940 | — | Sperm in epididymis |
| SAM 36973 | 2 400 | — | 500 ×– | 420 ×– | 3605 | 1815 | 5420 | 270 | Sperm in epididymis |
| PEM 1519/96 | 2 410 | 12 | *140 × 35 | 140 × 40 | 102 | 115 | 217 | 100 | Sperm absent from epididymis |
| PEM 1519/97 | 2 500 | — | *500 × 120 | 490 × 120 | 3305 | 3010 | 6315 | 253 | Copious sperm in epididymis |

*side unknown.

Three stomachs contained only milk, and one, that of PEM 1519/05, contained milk and remains of solid food. The stomachs of PEM 1515/05 and 1516/05 contained one and two cephalopod beaks respectively. The identity and numbers of prey items in 16 stomachs are provided in Table 94. In these 16 stomachs fish formed the bulk of the prey (77% of 500 items) and cephalopods formed the remainder (23%). Pilchard, *Sardinops ocellata*, and Redeye Herring, *Etrumeus teres*, together constituted 60,4% of all items (78% of all fish). In the seven stomachs examined from Natal waters 73% of all prey items (115) were pilchards and two *Loligo* were the only recorded cephalopods. In nine stomachs examined from eastern Cape waters cephalopods constituted 29,4% of all items (385). The higher proportion of cephalopods taken in eastern Cape waters may reflect their greater availability there, or may be a reflection of the origin of the material, for all nine eastern Cape specimens were stranded or found dead at sea whereas six Natal specimens for which the localities are known were captured in the shark nets.

The high percentage of pilchards in the stomachs of specimens from Natal waters probably reflects the association between *D. delphis* and the annual 'Sardine Run' in which large shoals of pilchards followed by numerous predatory fish, dolphins and birds, move north-eastwards along the Transkei and Natal coast in the winter months. The influx of pilchards usually occurs in June or July but may occur between June and September (Baird, 1971). The occurrence of *D. delphis* in Natal is markedly seasonal, there being records for June (1), July (3), August (1) and mid-1975 (1). In October 1964, 93 *D. delphis* were caught in the shark nets off Durban at a time when unseasonal shoals of 'sardines' were present off Natal. Examination of stomach contents showed that the dolphins had been feeding on 'sardines' (Anon. 1965).

Prey items taken by *D. delphis* are generally small. The largest item recorded in the present material was a 330 mm TL *Euthynnus affinis* caught by PEM 1519/83. Most prey species taken (96% of all items) occur in schools or are locally concentrated. In five of the nine sightings listed in Table 85 *D. delphis* was noted feeding in assocation with diving gannets, which prey almost entirely on shoaling fish (Rand, 1959), and in one of these instances, kob, *Argyrosomus hololepidotus*, were caught by the author underneath feeding *D. delphis* and were found to contain undigested, intact *Sardinops ocellata*.

The feeding preference of *D. delphis* in other regions also seems to be for prey which forms schools. In the coastal areas of the Black Sea *D. delphis* feeds predominantly on concentrations of sprat, anchovy and lesser amounts of pelagic pipe fish, Black Sea whiting and red mullet in their pelagic stages, *Trachurus trachurus, Pomatomus saltatrix* and *Sarda sarda*. Offshore the sprat forms 99% of the food of *D. delphis* in summer, when the sprat distribution appears to determine the distribution of the dolphins (Tomilin, 1957). Fraser (1946) concluded that the increase in the number of *D. delphis* on the east coast of Britain in 1937 was correlated with an unusual invasion by the ommastrephid squid, *Todarodes sagittatus*, of the North Sea. Fisher (*in* Legendre, 1922) stated that *D. delphis* fed primarily on sardines and horse mackerel, *Trachurus trachurus*, on the French coast. The stomach of a specimen from the Mediterranean contained 15 191 otoliths, including those of clupeids, scombrids and myctophids (Schmidt, 1923). An adult female harpooned off Nova Scotia had been feeding on garfish, *Scomberesox saurus*, (Sergeant and Fisher, 1957).

Off California *D. delphis* feeds primarily on the anchovy *Engraulis mordax*, the squid *Loligo opalescens* and lesser amounts of bathylagids, myctophids, hake *Merluccius productus*, and some crustaceans (Evans, 1976). Similar feeding habits were noted in the same region by Brown and Norris (1956), Fiscus and Niggoll (1965) and Fitch and Brownell (1968). Evans (1976) provided evidence indicating, at least for the months of September through February, that the prey abundance and distribution influenced the abundance of *Delphinus* in this region.

*Parasites:* Cyamids were collected from the lip of the blowhole of PEM 1520/69 and from the blowhole, corner of the eye and the angle of the gape of PEM 1521/30.

Nematodes were observed in the stomachs of seven of the 17 animals examined for them.

TABLE: 94

Numbers of prey items in the stomachs of 18 *Delphinus delphis* from the SE coast of southern Africa.

| | PEM 1517/59 | PEM 1519/00 | PEM 1519/01 | PEM 1519/03 | PEM 1519/22 | PEM 1519/81 | PEM 1519/83 | PEM 1519/84 | PEM 1519/85 | PEM 1519/94 | PEM 1519/96 | PEM 1519/97 | PEM 1520/23 | PEM 1520/59 | PEM 1520/69 | PEM 1521/30 | Total | % Frequency |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CLUPEIDAE | | | | | | | | | | | | | | | | | | |
| *Sardinops ocellata* | | | | | | 12 | 21 | 49 | 2 | | | 71 | | | | 4 | 159 | 31,8 |
| *Etrumeus teres* | | | | | | | | | | | | 132 | | | | 10 | 142 | 28,4 |
| MYCTOPHIDAE | | | | | | | | | | | | | | | | 46 | 46 | 9,2 |
| GADIDAE | | | | | | | | | | | | | | | | | | |
| *Merluccius* cf. *capensis* | | | | | | | | | | | | | | 1 | | | 1 | 0,2 |
| ACROPOMATIDAE | | | | | | | | | | | | | | | | | | |
| *Acropoma* sp. | | | | | | | | 1 | | | | | | | | | 1 | 0,2 |
| CARANGIDAE | | | | | | | | | | | | | | | | | | |
| *Trachurus trachurus* | | 1 | 6 | | | | | | | | | 3 | | | | | 10 | 2,0 |
| POMADASYDAE | | | | | | | | | | | | | | | | | | |
| *Pomadasys olivaceum* | | | | | | | | | | | | | 2 | | | | 2 | 0,4 |
| SCOMBRIDAE | | | | | | | | | | | | | | | | | | |
| *Scomber japonicus* | | 8 | 9 | | | | | | | | | 2 | 1 | | | | 20 | 4,0 |
| *Euthynnus affinis* | | | | | | | 1 | | | | | | | | | | 1 | 0,2 |
| EPHIPPIDAE | | | | | | | | | | | | | | | | | | |
| *Drepane punctata* | | | 1 | | | | | | | | | | | | | | 1 | 0,2 |
| Unidentified fish | | | | 2 | | | | | | | | | | | | | 2 | 0,4 |
| LYCOTEUTHIDAE | | | | | | | | | | | | | | | | | | |
| *Oregoniateuthis* | | | | | | | | | | | | | | | | 36 | 36 | 7,2 |
| CRANCHIIDAE | | | | | | | | | | | | | | | | | | |
| *Pyrgopsis* | | | | | | | | | | | | | | | | 1 | 1 | 0,2 |
| LOLIGINIDAE | | | | | | | | | | | | | | | | | | |
| *Loligo reynaudi* | 1 | | | | | | 2 | | | 6 | 1 | 8 | 4 | 36 | 6 | 1 | 65 | 13,0 |
| SEPIIDAE | | | | | | | | | | | | | | | | | | |
| *Sepia* sp. | | | | | 4 | | | | | 2 | | | | | 6 | | 12 | 2,4 |
| Unidentified cephalopods | | | | | | | | | | | | | | | | 1 | 1 | 0,2 |
| | | | | | | | | | | | | | | | | | 500 | 100 |

These were identified as *Anisakis* species in one specimen. Tapeworms were collected from the intestines of three animals. No parasites were seen in the kidneys, livers, lungs or hearts of ten, six, eight and four specimens examined respectively for them, though caseous nodules perhaps of helminthic origin were present in the lungs of three juveniles.

Cestode cysts (*Phyllobothrium* sp?) were seen in 11 of 15 specimens for which presence or absence was noted. These were particularly abundant around the anal opening and in the caudal blubber. Retroperineal cysts ( *Monorygma* sp?) were found in PEM 1519/01.

Nematodes were found in the air sinuses of PEM 1519/00, 1519/01 and 1519/94.

*School size*: Eight schools of *D. delphis* observed off the SE coast contained *c.*100 to 1 000–5 000 individuals (Table 85). SAM 36973 was collected from a school of about 100 animals. Gambell *et al.* (1975) observed two schools of *D. delphis* containing *c.*75 animals and *c.*200 animals at 33° 58′S, 57° 40′E and 34° 05′S, 48° 19′E respectively.

Variation in these school sizes is similar to that recorded elsewhere. In the Black Sea aggregations of several thousand form when food is particularly abundant but break up as food becomes more dispersed (Tomilin, 1957). In Californian waters school sizes ranged from 5 to 3 000 (Evans, 1976) and from one to hundreds (31 of 45 schools contained fewer than 30 animals) (Brown and Norris, 1965; Fiscus and Niggol, 1965). In the Mediterranean numbers in schools ranged from 20–*c.*1 000 animals (Pilleri and Knuckey, 1969) and Gaskin (1968b) recorded six schools containing 20–30 animals.

### DISTRIBUTION AND MIGRATION

*D. delphis* is distributed widely throughout the North Atlantic as far north as Norway and Iceland, the Mediterranean, the Black Sea, the tropical Atlantic and off Tristan da Cunha (Tomilin, 1957; Cadenat, 1958; Mitchell, 1970). In the Indian Ocean *Delphinus (D. tropicalis)* occurs in Somali waters and off the coasts of Malabar and Pakistan (Van Bree, 1971c; Pilleri and Gihr, 1972, 1973/74). In the North Pacific *Delphinus* occurs in the coastal waters of Japan (Takemura *et al.*, 1967). In the eastern Pacific it occurs from the equator to about 36° N (Evans, 1976) and along the west coast of South America from about 5° S to 40° S (Aguayo, 1975), and in the western Pacific it occurs in New Zealand, Tasmanian and Australian waters and around the Fiji and Tonga Islands (Davies, 1963b; Gaskin, 1968b; Aitken, 1971).

In southern African waters *D. delphis* occurs on the west coast (Sclater, 1901), a skull of *Delphinus* was examined by the author at Sandwich Harbour, South West Africa (23° 20′S) and van Bree and Purves (1972) tabled a record from Angolan waters, off Port Amboim (10° 47′S). On the SE coast specimens have been collected between Plettenberg Bay (23° 25′E) and Umhloti (31° 08′E) (Fig. 39) and a skull without data in the Mossel Bay museum was probably of local origin. The distribution of the few sightings of *D. delphis* (Fig. 39) compared to the area surveyed at sea (Fig. 43) suggests that this species is neritic in this region, occurring over the continental shelf. *D. delphis* has, however, been recorded offshore in the south-west Indian Ocean by Gambell *et al.* (1975) several hundred miles south east of Madagascar.

The numbers of records by month of *D. delphis* on the eastern Cape and Natal coasts are given in Table 95. The seasonal occurence of this species in Natal waters has been discussed briefly under feeding. The majority of the eastern Cape records occur in the warmer summer months. The apparent scarcity of *D. delphis* from eastern Cape waters in winter supports the suggestion that this species moves into Natal waters at this time of the year, probably in response to a similar movement by large shoals of fish, notably pilchard, *Sardinops ocellata*.

Evans (1976) suggested that a net southward movement by *D. delphis* on the Californian coast between December and June could involve adult females moving into warmer water to calve. In this region the calving season appears to be bimodal, with peaks in spring and fall. The available data on calving on the SE coast of southern Africa are too scanty to suggest that

TABLE 95:

Numbers of records of *Delphinus delphis* by month on the SE coast of southern Africa.

| | January | February | March | April | May | June | July | August | September | October | November | December |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EASTERN CAPE | | | | | | | | | | | | |
| Specimens | 3 | 5 | 1 | 2 | 1 | 1 | — | 1 | 1 | 4 | 4 | 7 |
| Sight Records | 2 | 3 | — | 1 | 1 | — | — | — | — | 1 | — | — |
| NATAL | | | | | | | | | | | | |
| Specimens | — | — | — | — | — | — | 3 | 1 | — | 1 | — | — |
| Sight Records | — | — | — | — | — | 1 | — | — | — | — | — | — |

calving occurs regularly in the winter months and that it is therefore a possible function of this seasonal movement into warmer water.

## Genus *STENELLA* Gray, 1866

*Proc. zool. Soc London*, 1866: 213; type species *Steno attenuatus* Gray by monotypy.

These are small to medium-sized dolphins attaining lengths of up to 2,5 m.

The body is slender to moderately robust. The beak is long and narrow (6–8% of body length) and the melon is well-formed and tapered anteriorly with a distinct apex. The body colour is basically dark dorsally and pale ventrally. In some species ontogenetic development of white or dark spots and blotches or darkening of the ventral surface changes the general pattern. A dark lateral stripe is present in one species. The dorsal fin is high (6–11% of total length) and may be falcate, erect, triangular or occasionally canted anteriorly. The flippers are of moderate length and falcate.

The rostrum is long and narrow (length and basal width 54–65% and 17–24% of CBL respectively). The premaxillae are convex on the dorsal surface of the rostrum and may be fused in the dorsal midline in the proximal part of the rostrum. Palatal grooves are absent or very shallow. The teeth are small and pointed; there are 33 to 60 teeth in each jaw. The number of vertebrae varies from 69 to 83.

The taxonomy of this genus at the specific level is extremely confused, largely as a result of inadequate series of specimens on which to establish limits of variation in most regions. The species of *Stenella* can be divided into three groups: (a) the striped dolphins currently included in a single species, *S. coeruleoalba* (Meyen, 1833), (Fraser and Noble, 1970); (b) the spotted dolphins, including *S. attenuata* (Gray, 1846) from the Indopacific region, *S. plagiodon* (Cope, 1866) in the Atlantic and a third species taxonomically close to *S. attenuata* and sympatric with *S. plagiodon*, probably referable to *S. frontalis* (G. Cuvier, 1829), if distinct (Perrin, 1975a); (c) the spinner dolphins which include *S. longirostris* (Gray, 1828) in the Pacific and two sympatric species, *S. longirostris* and *S. clymene* (Gray, 1850), in the Atlantic, (Perrin *et al.*, 1977b). The situation is further complicated by geographical variation. Three morphologically distinct races (two unnamed) of *S. attenuata* and four unnamed races of *S. longirostris* are known in the tropical Pacific (Perrin, 1975b). Similar variation should be expected elsewhere.

Three species of *Stenella*, identified as *S. coeruleoalba*, *S. attenuata* and *S. longirostris*, are recorded from the SE coast of southern Africa.

### ***Stenella coeruleoalba*** (Meyen, 1833)
### Euphrosyne Dolphin

*Delphinus coeruleo-albus* Meyen, 1833: 609 (holotype, skeleton, Zoological Museum, Berlin; type locality, Rio de La Plata region, South America).
*Delphinus styx* Gray, 1846: 39 (type locality: South Africa).
*Delphinus euphrosyne* Gray, 1846: 40.
*Prodelphinus euphrosyne* Flower, 1885a: 29; Sclater, 1901: 207; FitzSimons, 1920: 225.
*Stenella styx* Roberts, 1951: 229; Ellerman, Morrison-Scott and Hayman, 1953: 329; Barnard, 1954: 28.
*Stenella euphrosyne* Davies, 1962: 22; Best, 1971: 6.
*Stenella coeruleoalba* Fraser and Noble, 1970: 147; Ross and Bass, 1971: 413.

#### RECORDS AND MATERIAL

Details of 46 records of *Stenella coeruleoalba* stranded or captured on the SE coast and those of 16 sight records are given in Tables 96 and 97 respectively and the distribution of these records is mapped in Fig. 40. An additional 13 sightings of this species in the south-west Indian Ocean between 20°–35°S and 39°–66°E are listed by Gambell *et al.* (1975).

TABLE 96:

Records of 45 *Stenella coeruleoalba* from the SE coast of southern Africa.

| Catalogue Number | Sex | Total length (mm) | CBL (mm) | Date | Locality | Comments |
|---|---|---|---|---|---|---|
| BM 1965.1.6.1*** | ♀ | 2 210 | — | 09.06.62 | Durban | Stranded alive with calf (below) |
| BM 1965.1.6.2*** | ♀ | 1 594 | — | 09.06.62 | Durban | Stranded alive Fraser and Noble (1970) |
| PEM 1496/65** | ♀ | — | 407 | 14.09.63 | Jeffreys Bay | Skull in PEM |
| ELM 855 | ♂ | — | — | 14.11.67 | Kaiser's Beach | Cast in ELM |
| PEM 1514/12 | — | — | 423+ | 09.06.68 | Woody Cape | Skull in PEM |
| PEM 1514/88 | — | — | 468 | June 1969 | Woody Cape | Decomposed |
| PEM 1515/03 | ♂ | — | 454 | Oct. 1969 | Durban | |
| PEM 1515/27 | — | — | — | Mar. 1970 | Jeffreys Bay | Dried skull brought in |
| PEM 1515/28 | ♂ | 1 905+ | 452 | 19.04.70 | Maitland R. Mouth | Tail cut off |
| PEM 1515/68*** | ♀ | 2 000 | 437 | Aug. 1970 | La Lucia | Ross and Bass (1971) |
| PEM 1515/75 | ♂ | 1 780 | 385+ | 04.10.70 | Woody Cape | |
| PEM 1515/90*** | ♂ | — | 475 | 09.11.70 | Paradise Beach | Stranded alive |
| —* | ♂ | — | — | 01.12.70 | Jeffreys Bay | Stranded alive |
| —** | ♀ | — | — | 04.12.70 | Port Elizabeth | Photos in PEM |
| —** | ♂ | 2 400 | — | 05.12.70 | Seaview | Photos in PEM. Stranded alive |
| PEM 1516/07*** | — | — | 461 | 09.10.70 | Mtunzini | |
| PEM 1516/14** | ♂ | — | — | 22.01.71 | Aston Bay | |
| — | ♂ | 2 415 | — | 24.03.71 | Nature's Valley | Stranded alive |
| PEM 1517/62** | ♂ | 1 920 | — | 12.01.72 | Cape St. Francis | Stranded alive |
| ELM 899 | — | — | 441 | 09.06.72 | Bonza Bay | |
| PEM 1518/00 | ♀ | 2 260 | — | 12.08.72 | Kabeljous R. Mouth | |
| PEM 1518/11 | — | — | 437 | Sep. 1972 | Oyster Bay | Skull in PEM |
| PEM 1518/12 | ♂ | 2 370 | — | 07.11.72 | Sundays R. Mouth | |
| PEM 1518/13 | ♂ | 2 060 | — | 01.11.72 | Gamtoos R. Mouth | |
| PEM 1518/20 | ♀? | — | — | 12.10.72 | Jeffreys Bay | Fresh skin brought in |
| PEM 1518/87 | — | (2 130) | 452 | 16.03.74 | 20 km west of Woody Cape | Decomposed |
| PEM 1518/88 | ♀ | 2 160 | — | 16.03.74 | 40 km west of Woody Cape | |
| — | ♀ | 2 220 | — | 31.10.74 | Cove Rock | |
| SAM 37135** | ♀ | 2 225 | — | 28.01.75 | 34° 28′ S, 26° 53′ E | Collected at sea |
| PEM 1519/19 | ♂ | 1 960 | — | 18.02.75 | Swartkops R. Mouth | Stranded alive |
| ELM 920* | ♂ | 2 345 | 491 | 29.04.75 | Haga Haga | |
| PEM 1519/74 | ♀ | 2 210 | 445 | Oct. 1975 | Sundays R. Mouth | Decomposed |
| PEM 1519/92 | ♂ | 2 500 | 473 | 22.12.75 | Noordhoek | |
| PEM 1519/93** | ♀ | 2 280 | 472 | 26.12.75 | Port Elizabeth | Stranded alive |
| PEM 1520/16** | ♂ | 2 390 | — | 03.09.76 | Willows, P. E. | Decomposed |
| PEM 1520/25 | — | — | — | Oct. 1976 | Sundays R. Mouth | Bleached skull |
| PEM 1520/26* | ♀ | 2 060 | — | 11.02.75 | Sedgefield | |
| PEM 1520/27 | ♂ | 2 440 | 449 | 04.11.76 | Coega River Mouth | Fresh |
| PEM 1520/29 | ♂ | 2 290 | — | 10.08.69 | Kini Bay | |
| PEM 1520/38** | ♂ | 2 180 | 465 | 13.08.76 | Plettenberg Bay | Stranded alive |
| PEM 1520/70 | — | — | — | Aug. 1977 | Bird Island | Worn skull |
| PEM 1521/07 | — | — | — | Mar. 1978 | Gibson Bay | Decomposed |
| PEM 1521/12*** | ♂ | 2 150 | — | 19.04.78 | Aston Bay | Fresh |
| PEM 1521/15 | ♂ | 2 300 | — | 26.04.78 | Kabeljous R. Mouth | Stranded on 24th April |
| PEM 1521/29** | ♂ | 1 860 | — | May 1978 | Mpelane | Stranded |

(  ) denotes approximate measurement.
Asterisks: *, **, *** denote one, two or three bands in the eye-to-flipper stripe.

TABLE 97:
Sight records of *Stenella coeruleoalba* on the SE coast of southern Africa. Data taken from IOS (1973, 1975) and Gambell *et al.*, (1975).

| Date | Number | Locality |
|---|---|---|
| 01.02.73 | *c.* 100 | 30° 21′ S, 31° 49′ E |
| 04.02.73 | *c.* 100 | 32° 15′ S, 29° 50′ E |
| 11.02.73 | *c.* 50 | 34° 31′ S, 26° 50′ E |
| 14.02.73 | *c.* 100 | 34° 36′ S, 27° 32′ E |
| 22.12.73 | 100 | 33° 33′ S, 30° 10′ E |
| 02.02.74 | 50 | 32° 51′ S, 34° 08′ E |
| 02.02.74 | 50 | 32° 44′ S, 33° 48′ E |
| 03.02.74 | 50 | 31° 15′ S, 31° 48′ E |
| 22.01.75 | sev. 100 | 35° 34′ S, 22° 48′ E |
| 22.01.75 | sev. 100 | 36° 25′ S, 22° 39′ E |
| 23.01.75 | 50–100 | 37° 00′ S, 22° 17′ E |
| 24.01.75 | sev. 100 | 37° 40′ S, 21° 01′ E |
| 24.01.75 | 4–5 | 37° 39′ S, 21° 39′ E |
| 27.01.75 | 5 | 34° 57′ S, 25° 24′ E |
| 28.01.75 | 100* | 34° 28′ S, 26° 53′ E |
| 30.01.75 | 11 | 33° 46′ S, 29° 51′ E |

* SAM 37135 collected from this school.

## SPECIFIC STATUS AND CHARACTERS

Dolphins currently identified as *Stenella coeruleoalba* (Meyen, 1833) are characterized by a distinct dark stripe between the eye and the anus, which contrasts strongly with the paler flanks and ventral surface, and a pale streak or spinal blaze (terminology of Mitchell, 1970) which curves from a point lateral to the dorsal fin anteroventrally towards the eye (Fig. 24). Several species with these characteristics have been described, including *Delphinus coeruleo-albus* Meyen, 1833 (= *Stenella coeruleoalba), Delphinus lateralis* Peale, 1848 and *Delphinus marginatus* Desmarest, 1850. True (1889) considered *D. marginatus* to be identical with *Delphinus euphrosyne* Gray, 1846 and *Delphinus styx* Gray, 1846 which were known only from skulls, on the similarity in their cranial features. His contention has been justified by new material acquired since then (Fraser and Noble, 1970).

The name *S. styx* had been used by some authors (Scheffer, 1953; Busnel *et al.*, 1968) in preference to *S. euphrosyne* since it held page priority over the latter. However, van Bree *et al.* (1969) pointed out that it would be more correct to follow the view of the first reviser (True, 1889) who synonymized *S. styx* under *S. euphrosyne*.

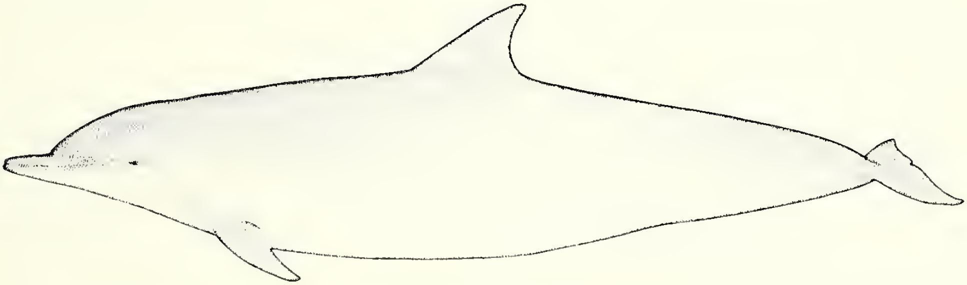


Fig. 24. Female *Stenella coeruleoalba*, 2,225 m in length, from Natal waters (SAM 37135).

A number of authors (Allen, 1939b; Roberts, 1951; Ellerman *et al.*, 1953; Hershkovitz, 1966) have continued to include the species *Clymene similis* Gray 1868 in the genus *Stenella*. The holotype, BM 1509b, was collected at the Cape of Good Hope. True (1889), however, included this species in the genus *Lagenorhynchus*, and the holotype is probably a specimen of the dusky dolphin *L. obscurus*.

Subsequent to True's (1889) revision, two forms of striped dolphins were recognized, either as full species *S. coeruleoalba* and *S. euphrosyne* (Norman and Fraser, 1948; Kellogg and Scheffer, 1947) or as subspecies of *S. coeruleoalba* (Tomilin, 1957); these were distinguished by the presence of a single or double dark stripe between the eye and the insertion of the flipper, and the presence or absence of the spinal blaze. Recently Fraser and Noble (1970), after examining the colour patterns of 24 specimens, concluded that such differences were not taxonomically important and therefore that all these striped dolphins should be considered to belong to a single species, *Stenella coeruleoalba* (Meyen, 1833).

The colour patterns of specimens examined in the present study support the conclusions of Fraser and Noble (1970). The eye-to-flipper stripe was single in three specimens from the eastern Cape and was composed of two bands in ten specimens (nine eastern Cape, one Natal) (Table 96). Fraser and Noble (1970) also described three specimens from Natal in which the eye-to-flipper stripe consisted of three bands. Three further triple-banded specimens from Natal, PEM 1516/07, and the eastern Cape, PEM 1515/90; PEM 1521/12, have now been examined. In these animals the distinction between the two ventral bands was not as clear as in those figured by Fraser and Noble (1970). A further variation was noted in three specimens from the Eastern Cape, PEM 1515/90, PEM 1519/93 and the specimen collected on 5 December 1970, in which the anterior 10–20% of the ventral band was divided by a pale streak into two distinct bands.

Indirect evidence that these variations can occur within a single population is given by four animals stranded in the eastern Cape in 1970 on 9 November (24° 54′E), 1 December (24° 55′E), 4 December (25° 31′E) and 5 December (25° 21′E) (Table 95). The dates and localities strongly suggest that these specimens came from a single population. Their eye-to-flipper stripes include the single-, double-, treble- and partially treble-banded variations described above.

The presence or absence of the spinal blaze appears to be related to the degree of exposure after stranding. A clear or faint spinal blaze was present in all 11 specimens photographed immediately or soon after death. It was absent in four specimens which had been exposed to the sun for several hours but were otherwise fresh. The presence of a spinal blaze was noted in at least three sightings of this species on 4 February, 11 February 1973 and 30 January 1975 (Table 97).

Comparison of the external measurements of *Stenella coeruleoalba* of more than 1,9 m in length from the north-eastern Atlantic, the Mediterranean (data from Fraser, 1953; van Bree *et al.*, 1969; Gihr and Pilleri, 1969; Duguy, 1975, 1976, 1977, 1978) and from the SE coast of southern Africa in Table 98 showed that different populations of this species are very similar in their external proportions.

A number of specimens collected in this study were too decomposed to show any colour pattern and their identification was based on the similarities in features of their skulls to those of *S. coeruleoalba* identified from external features. The skull of *S. coeruleoalba* is characterized by having a rostrum of moderate length (54–60% CBL), broad at its base (19–27% CBL), having 39 to 53 teeth in each jaw and lacking palatal grooves. Measurements of skulls from the North Atlantic (11 specimens), North Pacific (three specimens) and South Atlantic waters (17 specimens), the present studys are compared in Table 99. No significant regional differences are indicated in this comparison.

The number of vertebrae ranges from 71–80 (van Bree *et al.*, 1969; present study).

### Table 98:

Comparison of external measurements of *Stenella coeruleoalba* from the north eastern Atlantic, (four specimens) the Mediterranean (17 specimens) and the SE coast of southern Africa (12 specimens). Total length is in mm; other measurements are expressed in percentages of total length. Data sources are provided in the text. Measurement numbers are keyed to Table 2.

| Measurement Number | NE Atlantic | | | Mediterranean | | | Southern Africa | | |
|---|---|---|---|---|---|---|---|---|---|
| | Mean | Range | N | Mean | Range | N | Mean | Range | N |
| 1 | 2 045 | 1 950–2 300 | 4 | 2 024 | 1 920–2 110 | 17 | 2 233 | 1 920–2 500 | 12 |
| 2 | 16,9 | 15,4–18,4 | 4 | 15,7 | 14,1–18,9 | 17 | 15,4 | 13,5–16,9 | 12 |
| 3 | 6,1 | 5,1–7,1 | 4 | 5,7 | 5,4–6,8 | 16 | 5,2 | 4,3–6,1 | 12 |
| 4 | 14,4 | 13,3–15,3 | 4 | 13,3 | 10,9–14,6 | 16 | 13,2 | 11,4–15,6 | 11 |
| 9 | 15,4 | 12,8–17,7 | 4 | 14,8 | 13,3–17,3 | 17 | 15,3 | 13,1–17,2 | 12 |
| 10 | 23,0 | 21,3–25,5 | 3 | 22,4 | 20,5–24,4 | 17 | 22,1 | 20,1–24,0 | 12 |
| 12 | 60,3 | 59,6–61,2 | 3 | 60,0 | 57,8–63,4 | 13 | 57,9 | 52,0–63,2 | 12 |
| 15 | 69,8 | 68,3–71,8 | 3 | 70,8 | 64,8–75,1 | 16 | 71,6 | 70,5–72,7 | 10 |
| 27 | 13,9 | 11,2–14,9 | 4 | 13,0 | 9,3–15,3 | 17 | 13,1 | 11,7–15,6 | 12 |
| 29 | 4,5 | 4,3–4,8 | 4 | 4,7 | 7,3–10,2 | 16 | 4,1 | 3,5–4,5 | 12 |
| 30 | 7,8 | 7,2–8,2 | 4 | 9,0 | 7,3–10,2 | 17 | 8,5 | 7,2–11,6 | 12 |
| 31 | 13,7 | 12,2–15,4 | 4 | 13,9 | 11,7–16,5 | 15 | 13,9 | 12,0–15,7 | 12 |
| 32 | 20,7 | 18,3–23,1 | 4 | 22,9 | 15,7–27,0 | 17 | 20,9 | 17,4–24,6 | 12 |

## DESCRIPTION

A female, SAM 37135, 2,225 m in length, is illustrated in Fig. 25.

The body is moderately robust, slightly compressed laterally anterior to the dorsal fin, becoming increasingly compressed towards the flukes. The melon is well-formed, slightly depressed dorsally, and tapers anteriorly to a distinct apex on the dorsal surface of the beak. The beak is distinct, tapering distally, and its length is about 4–6% of body length. The number of erupted teeth ranged from 35 to 44 (mean 39,4) in each upper jaw and 39 to 46 (mean 41,9) in each mandible of 10 specimens over 1,86 m in length. The dorsal fin is moderate in height (7,2–11,6% of total length), falcate and set at midlength of the body. The length of the flippers varies from 11–16% of body length and these are falcate with a convex leading edge.

External measurements for 14 *S. coeruleoalba* from the SE coast are given in Table 100.

The dorsal surfaces of the beak, of the body to midway between the dorsal fin and flukes and of the appendages, the lower lips and the mandible tip are dark bluish grey. This dark colouration is most extensive laterally anterior to the dorsal fin, where its ventral margin is in-

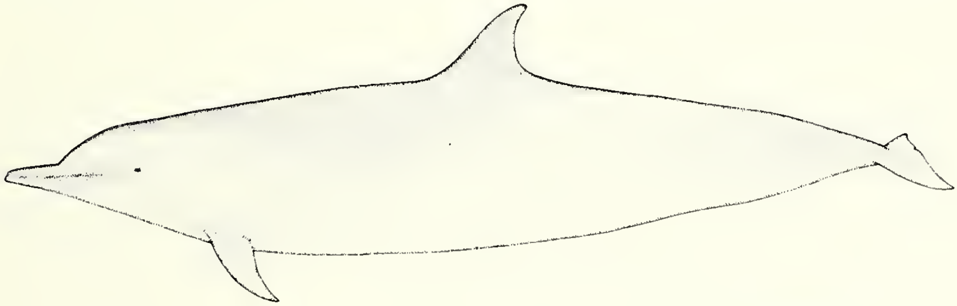


Fig. 25. Adult female *Stenella attenuata*, 2,135 m in length, from Natal waters (SAM 38869).

Table 99:

Comparison of skull measurements of *Stenella coeruleoalba* from the North Atlantic (11 specimens), North Pacific (three specimens) and southern African waters (19 specimens). Condylobasal lengths (No. 1) are in mm; other measurements, except tooth counts are expressed as percentages of CBL. Data from North Atlantic specimens are taken from van Bree (1973), van Bree *et al.* (1969), Busnel *et al.* (1969), Caldwell and Caldwell (1969), Fraser (1953), Odell and Chapman (1976), Tomilin (1957) and True (1889). Data for Pacific specimens are from Kellogg and Scheffer (1947), Scheffer (1953) and Tomilin (1957). Measurement numbers are keyed to Table 6.

| Meas. No. | North Atlantic | | | North Pacific | | | Southern Africa | | |
|---|---|---|---|---|---|---|---|---|---|
| | Mean | RAnge | N | Mean | Range | N | Mean | Range | N |
| 1 | 415 | 341–475 | 11 | 453 | 436–475 | 3 | 454 | 407–491 | 17 |
| 2 | 57,9 | 54,5–64,0 | 10 | 56,9 | 54,7–58,5 | 3 | 58,1 | 55,7–59,4 | 17 |
| 3 | 23,8 | 19,1–26,9 | 10 | 24,2 | 22,7–25,0 | 3 | 24,5 | 22,8–26,5 | 17 |
| 4 | 15,4 | 13,7–17,2 | 7 | 16,5 | 15,8–17,2 | 2 | 16,9 | 15,1–18,0 | 17 |
| 5 | 12,9 | 11,0–15,5 | 8 | 12,6 | — | 1 | 13,6 | 12,4–14,6 | 17 |
| 6 | 6,7 | 6,2–7,0 | 3 | 6,9 | — | 1 | 6,8 | 6,0–8,0 | 17 |
| 7 | 69,6 | 64,5–72,6 | 5 | 63,2 | — | 1 | 70,2 | 66,8–77,1 | 17 |
| 8 | 71,3 | 67,4–75,4 | 4 | — | — | — | 71,2 | 69,2–74,1 | 14 |
| 9 | 43,2 | 40,4–47,5 | 8 | 45,4 | — | 1 | 44,1 | 41,4–46,0 | 16 |
| 10 | 47,4 | 43,0–51,8 | 8 | 49,6 | — | 1 | 48,4 | 45,4–50,6 | 15 |
| 11 | 40,8 | 34,7–44,7 | 4 | — | — | — | 45,4 | 42,5–48,1 | 17 |
| 12 | 11,4 | — | 1 | — | — | — | 10,5 | 9,4–11,9 | 17 |
| 13 | 46,5 | 42,1–50,8 | 8 | 51,8 | 49,1–56,4 | 3 | 48,2 | 44,9–50,3 | 16 |
| 14 | 19,4 | 17,1–21,2 | 10 | 19,6 | — | 1 | 18,5 | 17,5–19,6 | 17 |
| 15 | 36,9 | 32,2–41,9 | 10 | 35,5 | 31,8–38,1 | 3 | 34,3 | 32,1–37,3 | 17 |
| 16 | 45 | 41–53 | 9 | 47,5 | 45–50 | 2 | 43,8 | 41–47 | 17 |
| 17 | 45 | 40–51 | 8 | 48,0 | 45–50 | 3 | 44,2 | 40–49 | 16 |
| 18 | 49,6 | 44,6–52,9 | 5 | 51,1 | — | 1 | 49,0 | 45,7–51,4 | 17 |
| 19 | 49,7 | 44,9–54,2 | 5 | 49,3 | 48,0–50,5 | 2 | 49,1 | 45,2–51,2 | 16 |
| 20 | 47,7 | 46,8–48,7 | 4 | — | — | — | 50,4 | 47,7–51,6 | 16 |
| 21 | 47,9 | 47,4–48,4 | 4 | — | — | — | 50,4 | 47,9–51,9 | 16 |
| 22 | 42,7 | 39–50 | 9 | 47,0 | 44–52 | 3 | 44,9 | 41–52 | 14 |
| 23 | 43,2 | 39–51 | 9 | 46,7 | 45–49 | 3 | 44,7 | 40–49 | 11 |
| 24 | 48,1 | 43,3–52,5 | 4 | 49,6 | 49,3–49,8 | 2 | 49,9 | 48,4–51,5 | 11 |
| 25 | 48,9 | 43,5–53,1 | 4 | 49,6 | 49,3–49,8 | 2 | 49,8 | 48,2–51,8 | 11 |
| 26 | 47,0 | 46,2–48,4 | 4 | 50,0 | — | 1 | 50,4 | 49,0–51,8 | 12 |
| 27 | 47,2 | 46,1–49,4 | 4 | 49,3 | — | 1 | 50,4 | 48,8–52,4 | 13 |
| 28 | 84,7 | 81,7–86,9 | 10 | 84,2 | 79,2–87,1 | 3 | 86,2 | 84,5–88,0 | 13 |
| 29 | 15,6 | 13,7–17,4 | 11 | 15,3 | 13,9–16,3 | 3 | 15,5 | 14,6–16,9 | 14 |
| 30 | 11,1 | 8,2–12,6 | 7 | 9,4 | 7,4–11,4 | 2 | 12,1 | 10,1–14,4 | 13 |
| 31 | 15,1 | 13,3–16,0 | 4 | 13,0 | — | 1 | 14,8 | 12,6–16,9 | 17 |
| 32 | 11,8 | 10,7–13,5 | 5 | 8,4 | — | 1 | 10,3 | 7,6–12,2 | 17 |
| 33 | 8,8 | 8,7–8,8 | 2 | — | — | — | 10,7 | 10,0–11,9 | 15 |
| 34 | 28,2 | — | 1 | — | — | — | 28,7 | 27,3–31,1 | 17 |

terrupted by the pale spinal blaze curving towards the dorsal fin. This spinal blaze is an extension of the pale bluish grey pigment which covers the lateral surfaces of the head and body to mid-depth of the body anteriorly and to the ventral midline on the caudal peduncle. The pale grey pigment extends anteriorly on the sides of the melon. The dorsal surface of the melon is slightly darker grey than the lateral surfaces but paler than the dark pigmentation of the dorsal surfaces of the beak and head posterior to the blowhole. This melon blaze was conspicuous on animals sighted at sea but appears to darken and disappear very rapidly once the animal is out of water. The ventral surface of the body is white from the chin to the anal aperture. The ventral surfaces of the flukes and flippers are dark bluish grey.

Thin dark grey lines form a bridle extending from the apex of the melon to the blowhole

TABLE 100:

External measurements in mm of 14 *Stenella coeruleoalba* from the SE coast of southern Africa. Measurement numbers are keyed to Table 2.

| Meas. No. | PEM 1515/75 ♂ | PEM 1521/29 ♂ | PEM 1517/62 ♂ | PEM 1519/19 ♂ | PEM 1520/12 ♂ | PEM 1520/38 ♂ | PEM 1519/74 ♀ | SAM 37135 ♀ | PEM 1518/00 ♀ | PEM 1519/93 ♀ | PEM 1521/15 ♂ | PEM 1518/12 ♂ | PEM 1520/27 ♂ | PEM 1519/92 ♂ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 780 | 1 860 | 1 920 | 1 960 | 2 150 | 2 180 | 2 210 | 2 225 | 2 260 | 2 280 | 2 300 | 2 370 | 2 440 | 2 500 |
| 2 | 310 | 310 | 325 | 330 | 340 | 330 | 340 | 315 | 370 | 360 | 330 | 380 | 330 | 360 |
| 3 | 105 | 100 | 110 | 120 | 115 | 120 | 110 | 122 | 115 | 120 | 115 | 130 | 105 | 115 |
| 4 | 260 | 260 | 265 | 305 | 280 | 285 | 280 | 270 | 305 | 310 | (285) | 320 | 280 | 310 |
| 5 | — | 350 | 370 | 410 | 390 | — | — | 370 | 425 | 410 | — | — | 380 | — |
| 6 | — | 50 | 51 | 55 | 60 | — | — | 60 | 65 | 60 | — | — | 60 | — |
| 7 | 60 | 55 | 57 | 60 | 65 | 55 | — | 60 | 60 | 60 | 60 | 60 | 60 | 55 |
| 8 | 160 | 180 | 195 | 190 | 220 | 210 | — | 195 | 210 | 210 | 225 | 190 | 200 | 200 |
| 9 | 290 | 320 | 330 | 330 | 340 | 360 | 310 | 340 | 360 | 360 | 320 | 370 | 320 | 350 |
| 10 | 460 | 400 | 440 | 470 | 490 | 460 | 470 | 490 | 520 | 520 | 480 | 550 | 490 | 540 |
| 11 | — | 850 | — | 910 | 975 | 970 | 970 | 995 | 1 060 | 1 080 | 1 030 | 1 085 | 1 090 | 1 120 |
| 12 | 1 000 | 1 110 | 1 170 | 1 210 | 1 125 | 1 310 | 1 150 | 1 240 | 1 430 | 1 330 | 1 310 | 1 380 | 1 410 | 1 450 |
| 13 | — | 870 | 945 | 950 | 1 030 | 990 | — | 1 040 | — | 1 090 | — | — | — | 1 160 |
| 14 | 1 180 | 1 200 | 1 250 | 1 270 | 1 410 | 1 370 | — | 1 510 | 1 580 | 1 550 | 1 440 | 1 510 | 1 540 | 1 560 |
| 15 | 1 300 | 1 340 | 1 395 | 1 410 | 1 560 | 1 550 | — | 1 570 | 1 640 | — | 1 640 | 1 670 | 1 750 | 1 780 |
| 16 | 6 | 8 | 0 | 9 | 2 | 3 | — | 5 | 5 | — | 5 | 0 | — | — |
| 20 | 920 | 880 | 915 | 990 | 1 070 | 1 020 | — | 1 020 | — | 1 120 | — | — | 1 060 | — |
| 21 | — | 1 020* | 940* | 1 060* | 1 060* | 1 100* | — | 1 100** | — | 1 200*** | — | — | 1 100* | — |
| 22 | 520 | 790 | 570 | 670 | 680 | 690 | — | 730 | 720 | 720 | 740 | 800 | 700 | — |
| 23 | — | 25 | 25 | 12 | 22 | 22 | — | 26 | — | 20 | — | — | 25 | — |
| 24a | — | — | — | — | — | — | — | 37 | 25 | 45 | — | — | — | — |
| b | — | — | — | — | — | — | — | 33 | 25 | 45 | — | — | — | — |
| 25a | — | 135 | 135 | — | 125 | 130 | — | — | — | — | — | — | 120 | — |
| b | 20 | 30 | 30 | — | 30 | — | — | — | (5) | — | — | (25) | 45 | — |
| c | — | — | — | — | — | — | — | 210 | — | 170 | — | — | — | — |
| 26 | 18 | 20 | 21 | 22 | 20 | 22 | — | 20 | 20 | 20 | 22 | 23 | 22 | — |
| 27 | 230 | 240 | 290 | 305 | 275 | 290 | 280 | 280 | 310 | 320 | 270 | 280 | 305 | 290 |
| 28 | 160 | 170 | 185 | 210 | 185 | 120 | 190 | 215 | 210 | 220 | 200 | 200 | 215 | 220 |
| 29 | 65 | 80 | 83 | 85 | 82 | 95 | 85 | 95 | 90 | 103 | 80 | 90 | 105 | 103 |
| 30 | — | 155 | 140 | 190 | 167 | 195 | 160 | 165 | 190 | 200 | 190 | 210 | 200 | 290 |
| 31 | 220 | 280 | 280 | 290 | 270 | 330 | 280 | 350 | 330 | 300 | 320 | 330 | 340 | 300 |
| 32 | 420 | 360 | 415 | 470 | 390 | 520 | 410 | 475 | 500 | 560 | 400 | 480 | 520 | 440 |
| 33 | 120 | 105 | 127 | 140 | 125 | 145 | 120 | 140 | 140 | 160 | 132 | 155 | 150 | 130 |
| 34 | 15 | 15 | 22 | 25 | 20 | 32 | 20 | 30 | 30 | 30 | 15 | 20 | 28 | 30 |

( ) denotes approximate measurement.
* measured at anterior insertion of fin.
** midway between fin and flipper.
*** at umbilicus.

and to the oval dark patch surrounding the eye. A dark grey stripe, variable in width between specimens extends from the ventral midline, posterior to the anus, to the eye or in two specimens to slightly above the eye. This stripe is subtended in all specimens by a secondary shorter stripe which extends from the eye to the level of the flipper tip or slightly beyond. A thin, isolated, dark abdominal streak may subtend the eye-to-anus stripe at its midlength (present in nine of 15 southern African specimens examined). A dark grey stripe extends from the anteroventral corner of the eye patch to the anterior insertion of the flipper and may be composed of one, two or three bands as described above.

Characters of the skull have been described briefly above. Skull measurements in mm are provided in Table 101 for 19 specimens from the SE coast.

The vertebral formulae of 11 southern African specimens are given in Table 102. The range of variation in these formulae was C7 T13–16 L20–25 Cd31–37 totalling 75–80 vertebrae, with a mean of 77,1 in seven animals. Elsewhere the numbers of vertebrae recorded were 71, 76 and 76 in three specimens from the Mediterranean (van Bree *et al.*, 1969; Busnel *et al.*, 1968) and 79 in a specimen from the western North Pacific (Tomilin, 1957). The holotype of *S. euphrosyne* had 76 vertebrae (True, 1889).

## BIOLOGY

*Age determination:* Dentine layer counts and data on the state of physical maturity, where available, for 14 *S. coeruleoalba* are presented in Table 103. Of two additional specimens, PEM 1519/19 was physically immature and PEM 1520/38 was physically mature.

Age determination in this species in Japanese waters has been studied by Kasuya (1972) and Miyazaki (1977) using counts of dentine layers and by Kasuya (1976) using cement layer counts. These authors showed that the alternation of the opaque with the translucent zone in the innermost layer of the tooth occurred in December and January, in the northern mid-winter, and concluded that one growth layer was deposited each year.

In the present sample only eight specimens were suitable for a similar comparison of the state of the innermost zone. The following results were obtained: thin, opaque—February, March; broad opaque—April, August, September; thin translucent—nil; broad translucent—October, November, January. Though the sample is very small and there is considerable overlap there is some evidence of seasonal succession, the opaque zone appearing to form in the summer and autumn and the translucent zone forming in the winter and spring. These results are consistent with the conclusion of Kasuya (1972) and Miyazaki (1977) but require confirmation from much larger samples.

*Growth and development:* No neonatal animals were recorded during the study. The mean length at birth of *S. coeruleoalba* in Japanese waters is 1,005 m (Miyazaki, 1977). The only nursing calf recorded in southern African waters was a 1,594 m long female stranded with its mother at Durban (Davies, 1962). Calves begin taking solid food at about 1,33 m in length and suckle up to 1,5 years of age at a length of about 1,74 m (Miyazaki, 1977).

The maximum length recorded was 2,50 m in a male, PEM 1519/92. The lengths of three physically mature males were 2,18 m, 2,24 m and 2,345 m, and of two physically mature females were 2,06 m and 2,28 m. These lengths are comparable with those observed by Miyazaki (1977) for Japanese animals, in which the mean body lengths attained were 2,38 m and 2,25 m for males and females respectively.

Total and partial body masses for 10 *S. coeruleoalba* are listed in Table 104. A length/mass relationship calculated from these data by the least squares method gave the equation:

$$Y = 4{,}377 \times 10^{-5}.\ X^{2{,}7301}\ (r = 0{,}91)$$

where Y = mass (kg), and X = body length (cm)

Since all but one of these animals had stranded and therefore may have been underweight

TABLE 101:

Skull measurements in mm for 19 *Stenella coeruleoalba* from the SE coast of southern Africa. Measurement numbers are keyed to Table 6. Specimens marked * were identified initially from the external colour pattern.

| Meas. No. | PEM 1515/75 | PEM 1496/65 | PEM 1514/12 | PEM 1515/68 | PEM 1518/11 | PEM 1519/19 | ELM 899 | PEM 1519/74 | PEM 1520/27 | PEM 1515/28 | PEM 1518/87 | PEM 1515/03 | PEM 1516/07 | PEM 1520/38 | PEM 1514/88 | PEM 1519/93 | PEM 1519/92 | PEM 1515/90 | ELM 920 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 385+ | 407* | 423+ | 437 | 437 | 437* | 441 | 445* | 449* | 452 | 452 | 454 | 461* | 465* | 468 | 472* | 473* | 475* | 491* |
| 2 | 215+ | 232 | 235+ | 261 | 252 | 256 | 261 | 248 | 252 | 263 | 258 | 268 | 265 | 273 | 278 | 273 | 280 | 273 | 289 |
| 3 | 98 | 102 | 110 | 106 | 107 | 105 | 105 | 114 | 119 | 103 | 109 | 118 | 109 | 118 | 114 | 118 | 115 | 118 | 112 |
| 4 | 72 | 71 | 76 | 70 | 72 | 77 | 74 | 75 | 79 | 70 | 72 | 79 | 78 | 83 | 80 | 81 | 85 | 82 | 74 |
| 5 | 60 | 56 | 63 | 60 | 57 | 63 | 61 | 57 | 65 | 56 | 61 | 64 | 64 | 64 | 62 | 68 | 69 | 64 | 61 |
| 6 | 28 | 30 | 33 | 31 | 29 | 31 | 31 | 29 | 30 | 27 | 32 | 31 | 34 | 29 | 31 | 34 | 38 | 31 | 30 |
| 7 | — | 272 | — | 312 | 307 | 312 | 313 | 300 | 312 | 318 | 313 | 322 | 322 | 330 | 327 | 333 | 334 | 330 | 352 |
| 8 | — | — | — | 320 | — | 314 | 313 | 310 | 316 | 323 | 319 | 328 | 320 | 333 | 328 | — | 340 | 339 | 364 |
| 9 | 177 | — | 205 | 190 | 193 | 198 | 194 | 204 | 199 | 187 | 198 | 198 | 210 | 205 | 208 | 217 | 200 | 206 | 213 |
| 10 | 190 | 202 | 225 | — | 212 | — | 218 | 223 | 227 | 205 | 217 | 222 | 233 | 228 | 228 | 239 | 222 | 233 | 232 |
| 11 | 182 | 184 | 213 | 200 | 198 | 199 | 201 | 209 | 207 | 192 | 204 | 206 | 212 | 208 | 210 | 227 | 210 | 216 | 218 |
| 12 | — | 47 | 49 | 48 | 52 | 42 | 49 | 45 | 47 | 44 | 49 | 47 | 50 | 47 | 44 | 49 | 47 | 49 | 50 |
| 13 | 188 | 197 | 222 | — | 210 | 212 | 218 | 219 | 223 | 203 | 212 | 218 | 232 | 224 | 223 | 237 | 222 | 226 | 230 |
| 14 | — | 79 | 86 | 82 | 84 | 81 | 80 | 80 | 88 | 80 | 82 | 82 | 87 | 84 | 87 | 88 | 89 | 89 | 86 |
| 15 | — | 149 | 159 | 151 | 147 | 147 | 152 | 162 | 152 | 152 | 150 | 148 | 148 | 157 | 156 | 176 | 155 | 157 | 172 |
| 16 | 49+ | 43 | 44+ | 47 | 41 | 46 | 47 | 43 | 41 | 42 | 47 | 42 | 43 | 42 | 46 | 44 | 44 | 42 | 46 |
| 17 | 49+ | 44 | 45+ | 47 | 40 | 46 | 49 | 43 | 40 | 43 | 44 | 44 | 43 | 43 | 46 | 44 | 45 | 39+ | 46 |
| 18 | — | 188 | — | 219 | 219 | 223 | 223 | 206 | 205 | 225 | 228 | 221 | 221 | 239 | 227 | 221 | 238 | 232 | 249 |
| 19 | — | 191 | — | 222 | 218 | 222 | 225 | 206 | 203 | 230 | 223 | 224 | 221 | 238 | 223 | 221 | 239 | — | 247 |
| 20 | — | 194 | — | 224 | 221 | 223 | 225 | — | 222 | 227 | 230 | 231 | 223 | 240 | 237 | 243 | 239 | 234 | 249 |
| 21 | — | 195 | — | 227 | 221 | 225 | 228 | 217 | 222 | 230 | 230 | 232 | 223 | 239 | 237 | 240 | 239 | — | 248 |
| 22 | 52 | 47 | 46 | 46 | 41 | 45 | — | 46 | 42 | 45 | 44(+2) | — | 41 | 42 | — | 44 | 41+ | 38+ | 46 |
| 23 | 48+ | 49 | — | 45 | 42 | 46 | — | 47 | 40+ | 43 | 47 | — | 40 | 43 | — | 45 | 40+ | 40+ | 45 |
| 24 | 198 | 204 | 210 | 214 | 223 | 223 | — | 216 | 218 | 232 | 233 | — | 223 | 232 | — | — | — | — | 246 |
| 25 | — | 207 | — | 212 | 223 | 223 | — | 216 | 217 | 229 | 234 | — | 222 | 233 | — | — | — | — | 238 |
| 26 | 200 | 205 | 215 | 218 | 224 | 224 | — | 218 | 224 | 234 | 235 | — | 226 | 235 | — | 234 | — | — | 248 |
| 27 | — | 210 | — | 217 | 225 | 224 | — | 217 | 224 | 233 | 237 | — | 225 | 234 | — | 238 | 234 | — | 242 |
| 28 | 342 | 354 | 370 | 368 | 381 | 382 | — | 383 | 382 | 382 | 392 | — | 402 | 396 | — | 410 | 401 | — | 432 |
| 29 | 62 | 65 | 73 | 68 | 67 | 68 | — | 67 | 75 | 66 | 69 | — | 75 | 68 | — | 76 | 75 | 73 | 72 |
| 30 | 51 | 49 | 60 | 51 | 52 | 44 | — | 53 | 57 | 51 | 65 | — | 61 | 54 | — | 59 | 48 | — | 68 |
| 31 | — | 63 | 68 | 66 | 61 | 65 | 65 | 66 | 76 | 61 | 69 | 64 | 73 | 69 | 77 | 63 | 68 | 73 | 62 |
| 32 | — | 42 | 49 | 42 | 49 | 42 | 48 | 46 | 55 | 47 | 48 | 50 | 46 | 43 | 53 | 36 | 55 | 52 | 40 |
| 33 | — | 41 | — | — | 43 | 47 | (50) | 47 | 53 | 44 | 45 | 54 | 52 | 51 | 48 | 56 | 52 | 49 | 49 |
| 34 | — | 122 | — | 122 | 118 | 123 | 129 | 137 | 127 | 126 | 127 | 129 | 128 | 127 | 148 | 147 | 137 | 131 | 135 |
| 35 | 31,5 | — | — | — | — | — | — | 35 | 34,5 | — | — | — | — | — | — | 34 | — | — | 33 |
| 36 | 31,5 | — | — | — | — | — | — | 35,5 | 34,5 | — | — | — | 34 | 32 | — | 34 | 35,5 | — | 33 |

TABLE 102:

Vertebral data for 11 *Stenella coeruleoalba* from the SE coast of southern Africa.

| Catalogue Number | Number of Vertebrae | | | | |
|---|---|---|---|---|---|
| | Cervical | Thoracic | Lumbar | Caudal | Total |
| PEM 1496/65 | 7 | 14 | 22 | 32 | 75 |
| PEM 1515/68 | 7 | 13 | 25 | 31 | 76 |
| PEM 1519/19 | 7 | 14 | 22 | 29(+3) | 72(+3) |
| PEM 1519/92 | 7 | 15 | 54 (+2) | | 76(+2) |
| PEM 1519/93 | 7 | 14 | 22 | 33 | 76 |
| PEM 1519/98 | 7 | 15 | 20 | 36 | 78 |
| PEM 1520/12 | 7 | 15 | 21 | 35 | 78 |
| PEM 1520/26 | 7 | 14 | 23 | 32(+2) | 76(+2) |
| PEM 1520/27 | 7 | 14 | 21 | 35(+1) | 77(+1) |
| PEM 1521/15 | 7 | 14 | 22 | 37 | 80 |
| PEM 1521/29 | 7 | 16 | 20 | 34 | 77 |

( ) denotes estimated number of missing verterbrae

TABLE 103:

Dentine growth layer counts and age data for 14 *Stenella coeruleoalba* from the SE coast of southern Africa.

| Catalogue Number | Total length (mm) | Sex | No. of dentine layers | Remarks |
|---|---|---|---|---|
| PEM 1496/65 | — | ♀ | 1,5 | Innermost zone broad, opaque. |
| PEM 1515/75 | 1 780 | ♂ | 2 | Innermost zone broad, translucent. |
| PEM 1517/62 | 1 920 | ♂ | 3 | Innermost zone broad, translucent. |
| PEM 1515/68 | 2 000 | ♀ | 6,5 | Innermost zone broad, opaque. Physically immature. |
| PEM 1520/26 | 2 060 | ♀ | 3 | Innermost zone narrow, opaque. |
| PEM 1520/16 | 2 060 | ♀ | 11+ | Crown worn flat. Pulp cavity occluded. Physically mature. |
| PEM 1518/87 | *c.* 2 130 | — | 6 | Innermost zone narrow, opaque. |
| PEM 1519/93 | 2 280 | ♀ | 12+ | Pulp cavity occluded. Physically mature. |
| ELM 920 | 2 345 | ♂ | 5,5 | Innermost zone broad, opaque. Physically immature. |
| PEM 1518/12 | 2 370 | ♂ | 11 | Innermost zone broad, translucent. |
| PEM 1520/27 | 2 440 | ♂ | 12+ | Pulp cavity occluded. Physically mature. |
| PEM 1519/92 | 2 500 | ♂ | 12+ | Pulp cavity almost occluded. |
| PEM 1515/03 | — | — | 13+ | Secondary dentine. Pulp cavity occluded. |
| PEM 1515/90 | — | ♂ | *c.* 15 | Secondary dentine. Pulp cavity occluded. Physically mature. |

Table 104:

Total mass (kg), partial body mass and intestine length (m) for 10 *Stenella coeruleoalba* from the SE coast of southern Africa. Partial mass is expressed as percentages of total mass.

| Catalogue Number | Total length (mm) | Total mass (kg) | Blubber | Meat | Heart Lung and Trachea | Heart | Liver | Kidneys | Intestine length |
|---|---|---|---|---|---|---|---|---|---|
| PEM 1521/29 | 1 860 | 75,8 | 12,3 | 41,0 | 3,15 | 0,61 | 3,52 | 0,65 | 17,6 |
| PEM 1517/62 | 1 920 | 68,1 | | | | | | | |
| PEM 1519/19 | 1 960 | 87,1 | | | | | | | |
| PEM 1521/12* | 2 150 | 78,5 | 9,7 | 46,8 | 5,23 | 1,13 | 3,10 | 0,90 | 21,5 |
| PEM 1520/38 | 2 180 | 106,0 | 11,3 | 39,8 | | | | | |
| SAM 37135 | 2 225 | 114,5 | | | | | | | |
| PEM 1519/93 | 2 280 | 126,6 | 9,1 | 48,7 | | | | | |
| PEM 1520/16 | 2 390 | 145,0 | | | | | | | |
| 5 Dec. 1970 | 2 400 | 156,1 | | | | | | | |
| PEM 1520/27 | 2 440 | 131,0 | 11,1 | 35,0 | | | | | |

* Spleen mass 85 g (0,11 per cent).

when weighed this relationship should be used with caution. Comparison of this regression coefficient with that obtained by Gihr and Pilleri (1968) for 12 *S. coeruleoalba* from the Mediterranean (b = 2,6104) suggested that the southern African animals were very slightly but not significantly (t = 0,196, df = 18) heavier per unit length than the Mediterranean specimens.

*Reproduction:* Ovaries were collected from five of the 12 females examined. Data on these are given in Table 105. In addition a single corpus albicans was noted in the right ovary of PEM 1519/74, 2,21 m in length. The 2,21 m long female, BM 1965.1.6.1, was lactating and accompanied by a calf (Davies, 1962) and is therefore considered sexually mature.

These few data suggest that female *S. coeruleoalba* become sexually mature at about 2,1 m in length in southern African waters. This estimate is consistent with the mean length of 2,16 m attained by females in Japanese waters at sexual maturity which occurs at about 8,8 years of age (range 5,5–12,5 years) (Miyazaki, 1977). The gestation period is estimated to be 12 months (Kasuya, 1972).

Reproductive data for 13 males are listed in Table 106. In most of these specimens the testes were too decomposed or macerated to determine their state of activity. Miyazaki (1977), however showed that males in Japanese waters on average reach puberty when a single testis weighs 6,8 g. In sexually mature males a single testis weighs 15,5 g or more. Since the relationship between testis mass and the development of spermatogenesis is likely to be similar in Japanese and southern African *S. coeruleoalba*, testis mass has been used here as an index of maturity. On these criteria four males 1,86 m–2,15 m (Table 106) are considered immature. The status of one male 2,06 m in length, is uncertain. The remaining males, 2,18 m–2,50 m in length, with testis masses of 25 g or more would be sexually mature. These few data suggest that the onset of sexual maturity occurs between 2,1 m and 2,2 m in length in southern African animals.

*Food and feeding*: Stomachs from 21 animals were examined. Five of these proved to be empty and the digested food remains in another specimen were not preserved. Five of the remaining 15 stomachs contained fish otoliths and cephalopod beaks, two stomachs held only otoliths and eight stomachs contained only cephalopod beaks. Numbers of identified prey items are presented in Table 107.

Though cephalopods occurred in more stomachs (13) than did fish remains (seven), numerically cephalopods constituted a far smaller proportion (19,4%) of the total number of prey

TABLE 105:

Ovarian data for five *Stenella coeruleoalba* from the SE coast of southern Africa.

| Catalogue Number | Total length (mm) | No. of dentine layers | Ovarian | | Diameter of Corpora albicantia (mm) and index | Total no. of Corpora | Remarks |
|---|---|---|---|---|---|---|---|
| | | | Dimensions (mm) | Mass (g) | | | |
| PEM 1520/26 | 2 060 | 3 | 33 × 12 × 5 | 1,7 | 0 | 0 | Immature. Numerous follicles up to 1 mm diameter. |
| | | | 34 × 14 × 5 | 2,0 | 0 | | |
| PEM 1515/68 | 2 000 | 6,5 | 32 × 18 × 18 | 3,0 | 5,5(166) | 1 | Few follicles. |
| | | | 32 × 12 × 7 | 1,9 | 0 | | |
| PEM 1518/88 | 2 160 | — | 22 × 24 × 10 | 3,3 | 10(600) | 1 | |
| | | | 25 × 11 × 8 | 1,4 | 0 | | |
| PEM 1518/00 | 2 260 | — | 42 × 10 × 9 (R) | 3,0 | 0 | 2 | |
| | | | 43 × 14 × 11 (L) | 4,7 | 8 (364); 8 (180) | | |
| PEM 1519/93 | 2 280 | 12+ | 27 × 13 × 6 (R) | 1,4 | 0 | 4 | Two small cystic follicles in each ovary. |
| | | | 34 × 20 × 9 (L) | 4,0 | 8 (224); 5 (45)<br>5 (45); 5 (20) | | |

TABLE 106:

Reproductive data for 13 male *Stenella coeruleoalba* from the SE coast of southern Africa.

| Catalogue Number | Total Length (mm) | No. of dentine layers | Size of testis (mm) | | Mass of testis (g) | | | Diameter of of tubules (μ) | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | | Left | Right | Reft | Right | Total | | |
| PEM 1521/29 | 1860 | — | *70 × 9 | 70 × 9 | 2,3 | 2,3 | 4,6 | 26 | |
| PEM 1517/62 | 1920 | 3 | 60 × 8 | 56 × 8 | 2,3 | 3,5 | 5,8 | 47 | |
| PEM 1519/19 | 1960 | — | *70 × 10 | 65 × 10 | 4,0 | 3,4 | 7,4 | 47 | |
| PEM 1518/13 | 2060 | — | *105 × – | 95 × – | — | — | — | — | Decomposing |
| PEM 1521/12 | 2150 | — | *77 × 10 | 72 × 10 | 5,2 | 5,2 | 10,4 | 49 | |
| PEM 1520/38 | 2180 | — | *130 × 30 | 130 × 30 | 48 | 51 | 99 | — | Testis macerated, sperm present. No sperm seen in epididymis |
| PEM 1521/15 | 2300 | — | *170 × 35 | 160 × 35 | 60 | 50 | 110 | — | |
| PEM 1518/12 | 2370 | 11 | 140 × – | 160 × – | — | — | — | — | Decomposing |
| PEM 1520/16 | 2390 | 11+ | 170 × – | 160 × – | 49 | 36 | 85 | — | |
| PEM 1520/27 | 2440 | 12+ | *105 × 25 | 90 × 25 | 25 | 25 | 50 | 70 | |
| PEM 1519/92 | 2500 | 12+ | *140 × 45 | 165 × 45 | 114 | 136 | 250 | 147 | Few sperm in tubules |
| PEM 1515/90 | — | *c.*15 | *160 × 35 | — | 94 | — | — | 172 | Few sperm in lumen |
| PEM 1515/03 | — | 13+ | *130 × 25 | 125 × 25 | 39,5 | 40 | 79,5 | (112) | Tissue very macerated |

* side not recorded.

items (859). Many of the fish otoliths examined were in an advanced state of digestion and it is probable that the presence of cephalopod beaks alone in some of these stomachs reflects differences in the digestion rates of otoliths and beaks and that numerically fish form a greater percentage of the prey than indicated by these stomach contents.

Myctophids constituted 66,5% of all recorded food items and 82,5% of all fish. Nearly all of the identified myctophids were *Symbolophorus* cf. *veranyi* or *Hygophum hygomi* and probably 99% of the unidentified myctophid otoliths belonged to these two species but were too digested for positive identification (Fitch, *in litt.*).

The distribution of many of these prey species suggests that these *S. coeruleoalba* had been feeding in oceanic waters or over the continental slope but that prior to stranding some had taken neritic forms such as *Loligo* and *Sepia.* The limited data on depth distributions of prey species suggest that some feeding may have occurred down to about 200 m below the surface, as indicated by the presence in those stomachs of *Nansenia* sp. (Fitch and Brownell, 1968), *Merluccius* (probably *capensis*) which moves up at night into midwater from the bottom (Jones and van Eck, 1967) and the benthic *Sepia.* However, the majority of prey items belonging to the genera *Symbolophorus, Hygophum, Ommastrephes* and *Loligo* are known to migrate into surface waters at night where presumably they would be more accessible, so that the preferred feeding depth of *S. coeruleoalba* is still uncertain from the present data.

All prey items were comparatively small and few, if any, are considered to have exceeded 250 mm in length. At least 80% of these items were from animals (myctophids, gonostomatids, histioteuthids, ommastrephids and lycoteuthids), which have luminous organs.

The diet of the southern African specimens is very similar to that recorded elsewhere. The stomach of a specimen stranded on the English coast contained 876 otoliths of *Gadus minutus*, 54 'cuttlefish' beaks and some eye lenses (Fraser, 1953). The stomach of an animal stranded in Florida contained several fish otoliths (Odell and Chapman, 1976). The most complete study of feeding in this species was made by Miyazaki *et al.* (1973) on 27 specimens taken in the Japanese dolphin fishery. All prey species identified were pelagic or semi-pelagic, and included fish

TABLE 107:

Numbers of prey items recorded from 15 stomachs of *Stenella coeruleoalba* from the SE coast of southern Africa.

| Prey | PEM 1515/68 | PEM 1515/90 | PEM 1517/62 | PEM 1518/00 | PEM 1518/13 | PEM 1519/93 | PEM 1519/98 | PEM 1520/16 | PEM 1520/27 | PEM 1520/29 | PEM 1520/38 | PEM 1521/07 | PEM 1521/12 | PEM 1521/15 | PEM 1521/29 | Total % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MYCTOPHIDAE | | | | | | | | | | | | | | | | |
| *Symbolophorus* cf. *veranyi* | | | | | | | | 103 | | | | | | | | 12,0 |
| *Hygophum hygomi* | | | | | | | | 78 | | | | | | | | 9,1 |
| *Hygophum hanseni* | | | | | | | | 8 | | | | | | | | 0,9 |
| *Diaphus* sp. | | | | | | | | 2 | | | | | | | | 0,2 |
| *Lampanyctus australis* | | | | | | | | 2 | | | | | | | | 0,2 |
| *Lampanyctus* spp. | | | | | | | 2 | 1 | | | | | | | | 0,3 |
| *Electrona* cf. *rissoi* | | | | | | | | 1 | | | | | | | | 0,1 |
| Unidentifiable myctophids | | | | | | | 309 | 35 | 3 | | | | 1 | | 26 | 43,5 |
| GONOSTOMATIDAE | | | | | | | | | | | | | | | | |
| *Gonostoma atlanticum* | | | | | | | | 1 | | | | | | | | 0,1 |
| *Photichthys argenteus* | | | | | | | | 22 | | | | | | | | 2,6 |
| ARGENTINIDAE | | | | | | | | | | | | | | | | |
| *Nansenia* sp. | | | | | | | | 6 | | | | | | | | 0,7 |
| SEARSIIDAE | | | | | | | | 1 | | | | | | | | 0,1 |
| BREGMACEROTIDAE | | | | | | | | | | | | | | | | |
| *Bregmaceros* sp. | | | | | | | | 1 | | | | | | | | 0,1 |
| MERLUCCIDAE | | | | | | | | | | | | | | | | |
| *Merluccius* sp. | | | 11 | | | | | 1 | | | | | 66 | | | 9,1 |
| DIRETMIDAE | | | | | | | | | | | | | | | | |
| *Diretmus* sp.? | | | | | | | | 1 | | | | | | | | 0,1 |
| LEPIDOPIDAE | | | | | | | | | | | | | | | | |
| *Lepidopus caudatus* | | | | | | | | | | | | | 7 | | | 0,8 |
| UNIDENTIFIED FISH | | | 2 | | | | | | | | | | 2 | | | 0,5 |
| HISTIOTEUTHIDAE | | | | | | | | | | | | | | | | |
| Type 4 | | | | | | | | | | | | | 1 | | | 0,1 |
| Type 7 | 1 | | | | | | | 2 | | | | | 2 | | | 0,6 |
| Type 8 | 1 | | | | | | | 1 | | | | | | | | 0,2 |
| CRANCHIIDAE | | | | | | | | | | | | | | | | |
| Type 1 | | | | | | | | 1 | | | | | | | | 0,1 |
| OMMASTREPHIDAE | | | | | | | | | | | | | | | | |
| *Ommastrephes caroli* | | | | | 1 | | | | | | | | 2 | | | 0,3 |
| *Nototodarus* sp.? | 1 | | | | | | | | | | | | | | | 0,1 |
| ONYCHOTEUTHIDAE | | | | | | | | | | | | | | | | |
| Type 2 | | 1 | | | | | | | | | | | 2 | | | 0,3 |
| LYCOTEUTHIDAE | | | | | | | | | | | | | | | | |
| *Oregoniateuthis* sp. | | | | 2 | 11 | | 8 | 38 | 1 | | 17 | 7 | | 1 | | 9,9 |
| CHIROTEUTHIDAE | | | | | | | | | | | | | | | | |
| Type 3 | | 1 | | | | | | | | | | | | | | 0,1 |
| LOLIGINIDAE | | | | | | | | | | | | | | | | |
| *Loligo reynaudi* | | 12 | | | | 6 | | | | 38 | 1 | 2 | | | | 6,7 |
| SEPIIDAE | | | | | | | | | | | | | | | | |
| *Sepia* sp. | | | | | | | | | | | 1 | | | 4 | | 0,6 |
| OCTOPODIDAE | | | | | | | | | | 1 | | | | | | 0,1 |
| UNIDENTIFIED CEPHALOPODS | | 1 | | | | | | 1 | | | | | | | | 0,2 |
| | | | | | | | | | | | | | | | | 99,7 |

(58,7% of all items), cephalopods including two ommastrephid genera (21,4%) and shrimps, predominantly of the genera *Bentheognema* and *Pasiphaea* (20,0%). Myctophids constituted 63,9% of 1 448 fish identified on facial bones. With the exception of the slender snipe-eel, *Nemichthys scolopaceus*, all food items taken by these specimens were less than 300 mm in length and 74% of all prey animals had luminous organs.

*Parasites:* A single *Xenobalanus globicipitis* was collected from the right flipper tip of PEM 1519/19. Several cyamids were collected from the lip of the blowhole of this specimen. External parasites were absent on nine other animals examined.

Cestode cysts were noted in the blubber of seven specimens and in three were especially numerous in the anal and caudal blubber. *Phyllobothrium delphini* was identified from these cysts in three animals. Internally, numerous large cysts of *Monorygma grimaldii* were found retroperineally in three specimens, in the pleura of one of these and in the epididymides of a further animal. *Tetrabothrius forsteri* was collected from the intestine of PEM 1519/19.

Nematodes were collected from the stomachs of six of ten specimens examined for them. The numbers seen were small, between two and ten worms per stomach. Those from PEM 1515/68 were identified as *Anisakis typica* and those from PEM 1519/93 and PEM 1520/27 as *Anisakis* sp.

Lungworms were noted in four of nine specimens examined. Those in PEM 1519/93 were identified as *Halocercus lagenorhynchi* and those in PEM 1520/27 as ?*Halocercus* sp. The left lung of the latter animal partly adhered to the lateral wall of the pleural cavity and completely adhered to the diaphragm and lower mediastinum. There were extensive purulent areas of necrotic tissue and smaller localized areas containing pus and lungworms. The mediastinal lymph nodes were enlarged to 50–75 mm in diameter and contained numerous white (fibrous) areas.

*School size:* The estimated size of 16 schools sighted off the SE coast ranged from four to five to several hundreds (Table 97). Similarly in the SW Indian Ocean, school sizes ranged from 25 to 500 (Gambell *et al.*, 1975). In both regions about half of the schools contained 100 or more individuals.

In the Pacific school size is similar, ranging from 7–*c.*1 000 (n = 30) (Hubbs *et al.*, 1973; Miyazaki *et al.*, 1974). Nearly half of these contained 100 or more individuals. However, counts made of schools captured in the Japanese dolphin fishery suggest that counts made during sightings may considerably underestimate the true number in a school. The mean size of 37 captured schools was 389 (range 25–1 832); 27 of these schools contained 100 or more individuals (Miyazaki, 1977).

### DISTRIBUTION AND MIGRATION

*S. coeruleoalba* is widely distributed in the tropical and warm temperate waters of the world. It occurs commonly in the Mediterranean and is recorded from the eastern Atlantic coasts of Europe and England (Duguy, 1977, 1978; Fraser, 1974; True, 1889). In the western North Atlantic there are records from the Gulf of Mexico, Jamaica (Caldwell and Caldwell, 1969) and off Nova Scotia (Sergeant *et al.*, 1970). An exceptional specimen was collected near Greenland (van Bree, 1973). In the South Atlantic this species is recorded from the coasts of Brazil (Hershkovitz, 1966), Uruguay (at 34° 49′S) and Argentina (at 38° 17′S) (Brownell and Praderi, 1976). In the Pacific *S. coeruleoalba* is recorded between the equator and about 50°N in the east and in the central tropical region between 10°N and 20°N (Perrin, 1975b). In Japanese waters this species forms a substantial part of the commercial dolphin catch (Miyazaki, 1977).

In southern African waters stranding records extend from Mpelane, Natal (32° 30′E) to False Bay, SW Cape (17° 30′E); almost all of these records (96%) occurred east of Mossel Bay (Fig. 40). Strandings of this species have been recorded on only three occasions between Mossel Bay and Cape Point and not at all on the western Cape coast (Best, *pers. comm.*). There is a single stranding record for the Mocambique coast, based on photographs in the files of the Branch Sea Fisheries, Cape Town, taken at Tofo Beach (23° 50′S, 34° 36′E) about 1970 (Best, *pers. comm.*).

Sight records off the SE coast (Table 97, Fig. 40) indicate that this species is oceanic, occurring beyond the continental shelf over depths of more than 1 000 m, and its distribution appears to be correlated with that of the Agulhas Current. In the SW Indian Ocean Gambell *et al.* (1975) saw this species on 13 occasions between 20°S and 35°S, and 39°E and 66°E, noting that it did not occur further south than 35°S and that it seemed to be restricted to water with a surface temperature of 22°C or more. Five sightings were made in the present study south of Mossel Bay between 35°S and 37° 40′S (Table 97) at positions with surface water temperatures of 24,2°C–25,4°C. These surface temperatures are indicative of Agulhus Current water and suggest that the southerly flow of the Agulhas Current in this region permits *S. coeruleoalba* to extend its range into higher latitudes than further east in the Indian Ocean.

Evidence supporting this suggestion is given by observations made in Japanese waters where this species occurs in the oceanic and coastal waters influenced by the warm Kuroshio Current and appears to concentrate along the northern periphery of this current (Miyazaki *et al.*, 1974). These authors suggest that movements of *S. coeruleoalba* in this region between the northern limits of 46°N in summer and 33°N in winter are related to seasonal changes in the position of the Kuroshio Current's northern boundary.

It is not yet established clearly whether similar seasonal movements occur off the southern African coast. The seasonal distribution of 35 dated stranding records off the SE coast suggest that this species occurs more frequently in eastern Cape waters in the warmer months (Table 108). Though the absence of this species off the eastern Cape in winter will not be confirmed until further offshore surveys are undertaken, the western limit of distribution appears to be further east in cooler months, perhaps either in response to changing water temperature or through effects of temperature on prey.

## ***Stenella attenuata*** (Gray, 1846)
## Spotted Dolphin

*Steno attenuatus* Gray, 1846: 44 (holotype, skull, BM 347b; type locality unknown); 1866: 235.
*Steno capensis* Gray, 1865b: 522.
*Clymenia capensis* Flower, 1883: 512.
*Prodelphinus attenuatus* Flower, 1885a: 30; True, 1889: 67, 165; Sclater, 1901: 207; FitzSimons, 1920: 225.
*Stenella attenuatus* Roberts, 1951: 229.
*Stenella attenuata* Ellerman, Morrison-Scott and Hayman, 1953: 329; Best, 1969: 121; 1971: 6; Gambell *et al.*, 1975: 247, 252.

### RECORDS AND MATERIAL

Data for 11 specimens and five sightings of *S. attenuata* recorded from southern African waters are provided in Tables 109 and 110 respectively, and their localities are mapped in Fig. 41. Gambell *et al.* (1975) list the localities of ten additional sightings of this species in the SWA Indian Ocean between 20°S–35°S and 40°E–66°E.

### SPECIFIC STATUS AND CHARACTERS

The taxonomic status of the spotted *Stenella* species requires further clarification. In the Indo-Pacific region all spotted dolphins appear to be referable to a single species, *S. attenuata* (Gray), which is represented by a number of populations which are similar to each other in cranial morphology, in having 34 to 48 teeth in each jaw and in having a flipper band of dark pigment which runs from the flipper insertion to the gape and which differ from each other primarily in the intensity of spotting (True, 1894; Perrin, 1975a).

In the Atlantic Ocean the status of spotted *Stenella* species is uncertain. Perrin (1975a)

TABLE 108:

Distribution by month of 35 stranding records of *Stenella coeruleoalba* on the SE coast of southern Africa.

| | January | February | March | April | May | June | July | August | September | October | November | December |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Natal Coast | — | — | — | — | 1 | 1 | — | 1 | — | 2 | — | — |
| Natal border to Cape Receife | — | 1 | 2 | 1 | — | 2 | — | — | — | 2 | 3 | 2 |
| Cape Receife to Mossel Bay | 2 | 1 | 1 | 3 | — | — | — | 3 | 1 | 1 | 2 | 3 |

TABLE 109:

Records of specimens of *Stenella attenuata* and *Lagenodelphis hosei* from southern African waters.

| Catalogue Number | Sex | Total length (mm) | CBL (mm) | Date | Locality | Comments |
|---|---|---|---|---|---|---|
| *S. attenuata* | | | | | | |
| BM 1519A | — | — | 413 | pre-1865 | Cape of Good Hope | Holotype of *Steno capensis* Gray. |
| SAM 35515 | ♀ | 2 145 | 415 | 04.07.64 | Durban | Best (1969) |
| SAM 36177 | ♀ | 1 830 | — | 19.08.69 | 30° 03′S, 31° 08′E | Collected from school of 40–50. |
| — | ♀ | 890 | — | Nov. 1970 | Natal coast? | In ORI deepfreeze. Neonate. |
| PEM 1517/68 | ♂ | 2 160 | 395 | 14.10.71 | Mtunzini | Stranded alive. |
| SAM 38869 | ♀ | 2 135 | — | 05.02.72 | 30° 26′S, 30° 54′E | Collected from school of 200–300. |
| PEM 1517/81 | ♂ | 1 980 | — | Feb. 1972 | Durban | — |
| PEM 1520/32 | ♂ | 885 | — | 1976 | Natal coast? | In ORI deepfreeze. Neonate or full-term foetus. |
| PEM 1520/33 | ♀ | *c.* 830 | — | 1976 | Natal coast? | In ORI deepfreeze. Neonate or full-term foetus. |
| PEM 1520/84 | ♂ | 1 820 | 387 | 1977 | Natal coast? | Fresh specimen. |
| PEM 1520/85 | ♂ | 2 200 | 404 | mid-Sept. 1977 | Mpelane | Fresh specimen. |
| *L. hosei* | | | | | | |
| SAM 36322 | ♀ | 2 360 | 429 | 17.02.71 | 30° 47′S, 30° 58′E | Collected at sea (Perrin *et al.*, 1973). |
| SAM 36323 | ♂ | 2 640 | 440 | 19.02.71 | 30° 09′S, 32° 20′E | Collected at sea (Perrin *et al.*, 1973). |
| PEM 1517/93 | ♀ | 2 255 | — | 17.02.72 | 29° 33′S, 32° 12′E | Collected at sea (Perrin *et al.*, 1973). |
| — | ♀ | 2 320 | — | 17.12.73 | 30° 05′S, 32° 06′E | Collected at sea (Gambell *et al.*, 1975). |
| PEM 1520/45 | ♂ | 1 617 | — | 14.01.77 | Sordwana Bay | Stranded. Died at ORI one week later, and was cast there. |
| ELM 938 | ♀ | 2 640 | 422 | 08.02.77 | Cefane River Mouth | Stranded. |
| PEM 1520/92 | — | — | 431 | 21.12.77 | Kasugha River Mouth | Decomposed carcase. |

TABLE 110:

Sight records for *Stenella attenuata* and *Lagenodelphis hosei* off the SE coast of southern Africa. Data are from I.O.S. (1972) and Gambell *et al.* (1975).

| Date | Number | Locality |
|---|---|---|
| *Stenella attenuata* | | |
| 08.02.72 | 20 | 31° 27′S, 30° 14′E |
| 17.12.73 | 200 | 30° 04′S, 31° 27′E |
| 20.12.73 | 25 | 30° 03′S, 31° 07′E |
| 21.12.73 | 100 | 32° 34′S, 30° 28′E |
| 03.02.74 | 40 | 31° 20′S, 31° 51′E |
| *Lagenodelphis hosei* | | |
| 08.02.71 | 30 | 30° 35′S, 31° 38′E |
| 08.02.71 | 300–400 | 30° 35′S, 31° 38′E |
| 10.02.71 | 10 | 30° 17′S, 31° 39′E |
| 10.02.71 | 40–50 | 30° 17′S, 31° 39′E |
| 15.02.72 | 30 | 31° 13′S, 31° 27′E |
| 20.01.75 | 7–8 | 33° 46′S, 27° 39′E |

provisionally recognised two forms. The first, referred to *S. plagiodon* Cope (True, 1889), is characterised by its large size, a flipper band between the flipper insertion and the eye and a spinal blaze (terminology of Mitchell, 1970) and is distributed in the warmer waters of the western Atlantic and possibly eastern Atlantic (Perrin, 1975a). The second form is variable in size and intensity of spotting and has a flipper band between the flipper insertion and the gape. It has 33 to 44 teeth in each jaw and is referred to *S. frontalis* (G. Cuvier) by Fraser (1950c), who distinguished it from North Atlantic *S. attenuata* on differences in proportional measurements of the skull. However, Best (1969) pointed out that measurements of a series of 39 *Stenella* skulls from St. Helena referred to *S.* cf. *capensis* by Fraser (1966) were intermediate between those of Fraser's (1950c) *frontalis* and *attenuata* groups, so that the taxonomic status of Fraser's (1950c) groupings requires re-evaluation.

Recently Perrin ( *in litt.*, 17 July 1981) indicated that further studies on North Atlantic material did suggest the presence of two species. However, they could not be distinguished readily on skull structure alone without additional external and post-cranial skeletal data. Since most of the published data for Atlantic specimens, including several holotypes, are for skulls only, it is not yet possible to compare the southern African material with Atlantic specimens to establish their relationships.

Skull measurements of small samples of *S. attenuata* from Japan and the Seychelles are compared in Table 111, and tested for possible significant differences ($\alpha = 0,05$) using the Kruskal-Wallis test. No differences were found in 14 of 19 proportional measurements. The re-

TABLE 111:

Comparison of the skull measurements of *Stenella attenuata* from Japan, Seychelles and southern Africa. Measurement numbers are keyed to Table 6.

| Meas. No. | *S. attenuata* Japan (Nishiwaki *et al.*, 1965b) | | | *S. attenuata* Seychelles (True, 1903; Fraser, 1950c) | | | *Stenella* sp. South Africa (Fraser, 1950c; Best, 1969; Table 112) | | | Kruskal-Wallis H-values |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | Range | N | Mean | Range | N | Mean | Range | N | |
| 1 | 407 | 381–428 | 7 | 400 | 379–415 | 6 | 403 | 387–415 | 5 | 0,98 |
| 2 | 59,9 | 57,8–61,5 | 7 | 60,7 | 58,6–61,7 | 6 | 59,7 | 58,9–60,5 | 5 | 3,03 |
| 3 | 22,4 | 21,5–23,3 | 7 | 23,1 | 21,7–24,2 | 6 | 22,6 | 21,0–24,8 | 5 | 1,67 |
| 4 | 14,9 | 14,2–15,4 | 7 | 13,5 | — | 1 | 15,9 | 14,6–17,7 | 5 | 3,84 |
| 5 | 11,3 | 10,8–12,1 | 7 | 10,2 | 9,7–10,8 | 6 | 11,4 | 9,9–12,7 | 5 | 4,98 |
| 7 | 69,3 | 68,0–70,5 | 7 | 70,1 | 67,5–72,5 | 6 | 69,5 | 68,0–70,5 | 5 | 3,40 |
| 8 | 71,4 | 70,1–73,0 | 7 | 72,2 | — | 1 | 70,6 | 69,8–72,1 | 4 | 1,07 |
| 9 | 40,0 | 38,7–42,8 | 7 | 37,2 | — | 1 | 39,6 | 37,1–42,3 | 5 | 2,16 |
| 10 | 43,7 | 42,2–45,9 | 7 | 41,7 | — | 1 | 44,3 | 42,7–44,7 | 5 | 3,03 |
| 13 | 39,7 | 37,3–42,6 | 7 | 41,5 | — | 1 | 43,9 | 42,1–46,3 | 5 | 7,88** |
| 14 | 17,6 | 16,6–18,4 | 7 | 16,5 | 15,9–17,6 | 6 | 16,8 | 16,0–17,7 | 5 | 6,93** |
| 15 | 36,8 | 35,3–39,1 | 7 | 31,1 | 29,4–34,0 | 6 | 32,8 | 31,8–33,7 | 5 | 13,44** |
| 20* | 51,1 | 48,7–52,6 | 7 | 52,1 | 50,4–53,3 | 6 | 50,9 | 49,4–52,3 | 5 | 5,23 |
| 26* | 50,5 | 49,5–51,9 | 7 | 50,2 | 49,1–50,6 | 6 | 50,1 | 49,1–51,5 | 5 | 0,05 |
| 28 | 83,6 | 84,1–89,8 | 7 | 84,1 | 82,4–85,2 | 6 | 84,4 | 83,5–85,9 | 5 | 3,70 |
| 29 | 14,7 | 14,0–15,2 | 7 | 14,6 | 13,4–15,6 | 6 | 14,4 | 14,0–14,9 | 5 | 1,79 |
| 30 | 17,3 | 16,0–18,8 | 7 | — | — | — | 17,6 | 16,0–19,5 | 4 | — |
| 31 | 14,1 | 13,4–14,7 | 7 | 15,8 | 14,5–16,6 | 6 | 16,9 | 15,8–18,2 | 5 | 12,0** |
| 32 | 9,0 | 8,1–10,2 | 7 | 13,1 | 11,3–14,2 | 6 | 12,3 | 11,4–13,5 | 5 | 12,6** |
| 33 | 7,7 | 7,5–8,1 | 7 | 6,5 | — | 1 | 7,9 | 7,0–8,1 | 4 | 3,15 |

* Maximum value for each specimen, whether left or right
** Significant at $\alpha = 0,05$

### TABLE 112:

Skull measurements in mm of three *Stenella attenuata*, two *Lagenodelphis hosei* and ten *Sousa plumbea* from the SE coast of southern Africa. Measurement numbers are keyed to Table 6.

| | *S. attenuata* | | | *L. hosei* | | *S. plumbea* | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Meas. No. | PEM 1520/84 | PEM 1517/68 | PEM 1520/85 | ELM 983 | PEM 1520/92 | PEM 1514/37 | PEM 1496/64 | PEM 1496/63 | SAM 1212* | SAM 35100* | ZMA 14.597* | PEM 1517/97 | ELM 30 | PEM 1517/95 | PEM 1511/18 |
| 1 | 387 | 395 | 404 | 422 | 431 | — | 515 | 520 | 534 | (541) | 548 | 560 | 561 | 564 | — |
| 2 | 231 | 233 | 238 | 234 | 242 | — | 316 | 326 | 335 | (339) | 351 | 347 | 355 | 352 | — |
| 3 | 91 | 98 | 88 | 124 | 125 | — | 110 | 113 | 118 | 116 | 116 | 117 | 121 | 115 | — |
| 4 | 65 | 70 | 64 | 89 | 89 | — | 82 | 85 | 89 | 83 | 81 | 87 | 89 | 85 | — |
| 5 | 46 | 50 | 49 | 71 | 74 | — | 50 | 49 | 54 | 51 | 47 | 51 | 50 | 49 | — |
| 6 | 24 | 30 | 28 | 33 | 32 | — | 32 | 32 | 38 | 35 | — | 33 | 34 | 33 | — |
| 7 | 263 | 277 | 280 | 286 | 297 | — | 353 | 358 | 377 | 373 | 389 | 391 | 354 | 394 | — |
| 8 | 270 | — | 282 | 290 | 297 | — | 366 | 376 | 395 | (405) | — | 404 | 406 | 412 | — |
| 9 | 155 | 167 | 162 | 207 | 216 | — | 186 | 191 | 204 | 195 | 198 | 207 | 208 | 200 | — |
| 10 | 173 | 183 | 182 | 227 | 236 | — | 218 | 215 | 236 | 222 | 224 | 236 | — | 226 | — |
| 11 | 159 | 171 | 171 | 213 | 220 | — | 190 | 194 | — | — | — | 212 | 215 | 204 | — |
| 12 | 42 | 41 | 46 | 45 | 47 | — | 53 | 54 | — | — | — | 56 | 59 | 55 | — |
| 13 | 172 | 183 | 179 | 224 | 233 | — | 218 | 212 | 234 | 218 | 224 | 233 | 238 | 230 | — |
| 14 | 65 | 70 | 69 | 75 | 75 | — | 84 | 89 | 91 | 91 | 88 | 89 | 93 | 85 | — |
| 15 | 123 | 133 | 131 | 159 | 164 | — | 127 | 128 | — | — | — | 129 | 130 | 139 | — |
| 16 | 38 | 37 | 38 | 40 | 39 | — | 32+ | 34 | 35 | 33+ | 34 | 36 | 35 | 38 | — |
| 17 | 39 | 37 | 39 | 42 | 40 | — | 36 | 33 | 36 | 33+ | 35 | 37 | 35 | 37 | — |
| 18 | 195 | 195 | 198 | 194 | 206 | — | — | 277 | 287 | 287+ | 297 | 298 | 302 | 298 | — |
| 19 | 195 | 196 | 198 | 192 | 198 | — | 268 | 268 | 286 | 283+ | 299 | 300 | 301 | 298 | — |
| 20 | 197 | 195 | 202 | 198 | 207 | — | — | 283 | — | — | — | 300 | 306 | 305 | — |
| 21 | 197 | 196 | 202 | 194 | 204 | — | 273 | 282 | — | — | — | 304 | 307 | 307 | — |
| 22 | 38 | 37 | 38 | 39 | 39 | 31 | 34 | 33 | 33 | 33 | 32 | 33 | 33 | 37 | — |
| 23 | 38 | 37 | 37 | 38 | 37 | 31 | 34 | 33 | 34 | 33 | 33 | 33 | 33 | 36 | 30 |
| 24 | 188 | 193 | 207 | 193 | 205 | 127 | 252 | 256 | 265 | 277 | 277 | 277 | 289 | 296 | — |
| 25 | 190 | 197 | 206 | 192 | 205 | 129 | 250 | 252 | 268 | 275 | 281 | 273 | 288 | 285 | 273 |
| 26 | 188 | 197 | 212 | 197 | 207 | 133 | 254 | 258 | — | — | — | 278 | 289 | 298 | — |
| 27 | 190 | 199 | 208 | 196 | 207 | 133 | 252 | 256 | — | — | — | 275 | 288 | 287 | 274 |
| 28 | 323 | 334 | 347 | 360 | 370 | 231 | 431 | 436 | 461 | 463 | 469 | 472 | 486 | 486 | 472 |
| 29 | 54 | 58 | 58 | 67 | 72 | 44+ | 84 | 86 | 92 | 90 | 91 | 93 | 91 | 96 | 94 |
| 30 | 62 | 74 | 65 | 44 | 39 | 57 | 118 | 131 | 139 | 131 | 136 | 144 | 140 | 150 | 131 |
| 31 | 66 | 72 | 64 | 70 | 71 | — | 120 | 115 | 120 | 106 | 109 | 128 | 129 | 131 | — |
| 32 | 44 | 50 | 48 | 46 | 55 | — | 80 | 80 | 93 | 83 | 84 | 86 | 92 | 94 | — |
| 33 | 32 | — | 35 | 55 | 59 | — | 25 | 35 | 40 | 42 | 34 | 38 | 37 | 36 | — |
| 34 | 103 | 109 | 109 | 128 | 138 | — | 137 | 133 | — | — | — | 143 | 154 | 142 | — |
| 35 | — | — | — | — | 32 | — | — | 34 | — | — | — | 36 | — | 36,5 | — |
| 36 | — | 30 | 30,5 | — | — | — | — | — | — | — | 35,5 | — | — | 37 | — |

* Measured by P. B. Best. ** Measured by P. J. H. van Bree. ( ) 10 mm added for breakage. Tooth counts for two neonatal *S. plumbea*: PEM 1515/76 $\frac{38 - 38}{34 - 34}$ : PEM 1515/77 $\frac{30 - 32}{30 - 30}$

maining measurements suggest that *S. attenuata* from Japanese waters have a slightly broader skull posteriorly (meas. 13, 15), broader premaxillae (meas. 14) and smaller post-temporal fossae (meas. 31, 32) than those of the southern African or Seychelles samples.

The external appearance of North Atlantic spotted dolphins is poorly known. Fraser (1950e) listed external measurements of one specimen referred to *S. frontalis* which Best (1969) compared to those of the Durban specimen (SAM 35515) and a series of Japanese specimens (Nishiwaki *et al.*, 1965b). Best (1969) concluded that Fraser's specimen had a proportionately shorter beak (4,5% of body length) than the South African animal or those in the Japanese series 5,3–7,7% of body length). The beak length of Best's (1969) specimen and five new specimens from southern Africa (Table 113) range from 4,5–5,7%, with a mean of 5,2% of body length, and are thus intermediate between those of the Atlantic animal and *S. attenuata* from Japan.

The colour pattern of *S. attenuata* (see Description and Fig. 25) varies ontogenetically, individually and between schools (Perrin, 1970). The colour pattern of dolphins referred to *S. frontalis* is less well-known, but Perrin (1970) noted that published descriptions and figures of colour patterns in *S. frontalis* did not differ from those he observed in *S. attenuata*. The colour pattern of a dolphin from the Lesser Antilles published by Caldwell *et al.* (1971a) as *Stenella* species B, and later as *S. frontalis* (Leatherwood *et al.*, 1976) closely resembles the adult or fused stage in the colour patterns of *S. attenuata* (Perrin, 1970).

The colour patterns of seven spotted dolphins from the SE coast of southern Africa (Best, 1969; present study) agree closely with those of *S. attenuata* in the eastern Pacific (Perrin, 1970), Japanese waters (Nishiwaki *et al.*, 1965a) and colour descriptions of Seychelles specimens (True, 1894), and are described in more detail below.

The vertebral formulae for five southern African *S. attenuata* are given in Table 113. In addition 78 vertebrae were counted in the neonate stranded in 1970 and the 1964 specimen (Best, 1969). The total number of vertebrae for these seven specimens ranged from 77–79 with a mean of 78,0. These figures are comparable to totals recorded for three *S. attenuata* from the Seychelles of 79, 78 and 79 (True, 1894) and 78 for an unstated number of specimens from Ja-

TABLE 113:

Vertebral data for five *Stenella attenuata* and seven *Sousa plumbea* from the SE coast of southern Africa.

| Catalogue Number | Number of vertebrae | | | | |
|---|---|---|---|---|---|
| | Cervical | Thoracic | Lumbar | Caudal | Total |
| *S. attenuata* | | | | | |
| PEM 1517/68 | 7 | 14 | 22 | 33 (+1) | 76 (+1) |
| PEM 1520/32 | 7 | 15 | 23 | 34 | 79 |
| PEM 1520/33 | 7 | 15 | 24 | 32 | 78 |
| PEM 1520/84 | 7 | 14 | 22 | 35 | 78 |
| PEM 1520/85 | 7 | 13 | 23 | 32 (+3) | 75 (+3) |
| *S. plumbea* | | | | | |
| PEM 1496/64 | 7 | 12 | 14 | 22 | 55* |
| ZMA 14.597 | 7 | 12 | 10 | 13 (+6?) | 42 (+6?) |
| PEM 1515/76 | 7 | 12 | 12 | 20 | 51 |
| PEM 1515/77 | 7 | 12 | 29 (+1) | | 48 (+1) |
| PEM 1517/95 | 7 | 12 | 11 | 20 | 50 |
| PEM 1517/97 | 7 | 11 | 12 | 18 (+2) | 48 (+2) |
| PEM 1520/65 | 7 | 12 | 10 | 20 | 49 |

( ) denotes estimated number of missing vertebrae.
* after Tietz (1963).

pan (Nishiwaki *et al.*, 1965b). *S. attenuata* from the eastern Pacific, however, have slightly more vertebrae (mean 81,1, range 79–83, n = 44) (Perrin, 1975a). The taxonomic significance of this difference is not yet clear.

In summary, the available data on external, cranial and post-cranial morphology supports Best's (1969) contention that southern African spotted dolphins are referable to *S. attenuata* as presently known from the Indo-Pacific region. However, the samples compared here are very small, and in view of the complexity of taxonomy in this genus, it would seem prudent to await more material from this region, to assist in evaluating the relationships between the spotted dolphins of the Atlantic and Indo-Pacific regions.

### DESCRIPTION

An adult female, SAM 38869, 2,135 m in length is illustrated in Fig. 25.

The body of *S. attenuata* is slender and streamlined. The melon is slightly depressed and elongate, tapering anteriorly to a distinct acute apex. The snout is narrow and moderate in length (4,5–5,7% of total length). The dorsal fin height is *c.*6–9% of body length and the fin is falcate and placed at midlength of the body. The flippers are short, recurved and apically pointed. A distinct ventral hump develops posterior to the anus in adult males (Perrin, 1975a) and was prominent in PEM 1520/85.

External measurements of five *S. attenuata* from the SE coast are provided in Table 114.

The colour pattern of *S. attenuata* changes with age through five categories defined and described in detail by Perrin (1970). In newborn animals the dorsal surfaces are dark purplish grey and the ventral surfaces are white. During growth the ventral surfaces become pale grey and the flipper-to-gape and eye stripes become more apparent (two-tone stage). Discrete dark grey and light grey spots begin to appear on the ventral and dorsal surfaces respectively (speckled stage). These ventral spots converge and overlap, initially showing some paler background colour between them (mottled stage) in subadults but eventually form a uniform darker grey surface (fused stage) in adults.

The colour patterns of the southern African specimens fitted three of these categories. There were no spots on the newborn calf stranded in November 1970 and the flipper-to-gape stripe was barely visible. No examples of the two-tone or speckled stages were examined. PEM 1517/81 and PEM 1520/84 were blackened considerably on their dorsal surfaces by exposure but the mottled pattern on their ventral surfaces clearly matched the mottled stage described by Perrin (1970). The colour patterns of the adults SAM 35515 (Best, 1969), SAM 38869, PEM 1517/68 and PEM 1520/85 showed the uniform ventral colour pattern of the fused stage.

The intensity of dorsal spotting varies in adult *S. attenuata* in the eastern Pacific, tending to be heaviest in the most eastern coastal animals and least in those animals farthest offshore (Perrin, 1975a). The spotting in SAM 38869, PEM 1517/68 and PEM 1520/85 was of medium intensity, by Perrin's (1975a) grouping, in which the spots were numerous and obvious with some merging above the eye and on the postero-dorsal part of the caudal peduncle. The illustration of SAM 35515 (Best, 1969) suggests that it was also moderately spotted, but details of the spotting are indistinct.

The skull of *S. attenuata* is small (up to 420 mm CBL) with a rounded cranium and a long rostrum (58–61% CBL) which tapers distally. Longitudinal palatal grooves are absent. The premaxillae are moderately arched transversely on the rostrum. Measurements of three skulls from the SE coast are provided in Table 112. Variation in the skull and postcranial skeleton of *S. attenuata* in the eastern Pacific has been treated in detail by Perrin (1975a).

An unusual feature of the skull of PEM 1517/68 was the almost complete fusion of the first three cervical vertebrae and the occipital condyles into a single unit. Similar pathological conditions have been reported for *Tursiops truncatus* and the beluga, *Delphinapterus leucas* (van Bree and Duguy, 1970).

Table 114:

External measurements in mm of five *Stenella attenuata*, one neonatal *S. longirostris*, two *Lagenodelphis hosei* and four *Sousa plumbea* from the SE coast of southern Africa. Measurement numbers are keyed to Table 2.

| | *S. attenuata* | | | | | *S. longirostris* | *L. hosei* | | *S. plumbea* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Measurement Number | PEM 1520/84 | PEM 1517/81 | SAM 38869 | PEM 1517/68 | PEM 1520/85 | PEM 1520/31 | PEM 1520/45 | ELM 928 | PEM 1515/76 | ZMA 14.597 | PEM 1517/97 | PEM 1517/95 |
| 1 | 1 820 | 1 980 | 2 135 | 2 160 | 2 200 | 825 | 1 617** | 2 640*** | 1 080 | 2 540 | 2 710 | 2 790 |
| 2 | 280 | 310 | 310 | 305 | 315 | 165 | 253 | 325 | 200 | 405 | 420 | 390 |
| 3 | 100 | 110 | 120 | 110 | 100 | 60 | 24 | — | 75 | — | 200 | 205 |
| 4 | 235 | 265 | 270 | 250 | 275 | — | 214 | — | 160 | 355 | 370 | 360 |
| 5 | 320 | 355 | 355 | — | 365 | — | 298 | — | 235 | — | — | — |
| 6 | 50 | 55 | 55 | — | 55 | — | 45 | — | 35 | — | — | — |
| 7 | 55 | 50 | 50 | 55 | 50 | — | — | — | 35 | 65 | 55 | 70 |
| 8 | 160 | 160 | 170 | 170 | 155 | — | — | — | (100) | — | 190 | 180 |
| 9 | 280 | 315 | 325 | 320 | 320 | 150 | 232 | — | 205 | 430 | 430 | 440 |
| 10 | 340 | 420 | 445 | 430 | 400 | 230 | 330 | 590 | 300 | — | — | 680 |
| 11 | 830 | — | 980 | 965 | 940 | 395 | 725 | 1 020 | 450 | — | 1 390 | — |
| 12 | 1 030 | 1 140 | 1 200 | 1 180 | 1 190 | 500 | 900 | 1 360 | 690 | — | 1 560 | 1 540 |
| 13 | 830 | 940 | 1 005 | 1 005 | — | 425 | 770 | — | 560 | — | 700 | — |
| 14 | 1 190 | 1 295 | 1 560 | 1 435 | 1 400 | 560 | 995 | — | 620 | — | 1 470 | 1 470 |
| 15 | 1 310 | 1 450 | 1 625 | 1 615 | 1 600 | — | 1 070 | — | 790 | — | 1 960 | 2 030 |
| 16 | 3 | 6 | 10 | 10 | 10 | — | 2,5 | — | 3 | 6 | 0 | — |
| 20 | 850 | (810) | 850 | 900 | 800 | — | 738 | — | 560 | — | 1 020 | (1 600) |
| 21 | 900 | (915) | 1 020 | 995 | 900 | — | 783 | — | 600 | — | 1 400 | — |
| 22 | 580 | 520 | 620 | 595* | 630* | — | 415 | — | 340 | — | 740* | 1 120* |
| 23 | 22 | 22 | 32 | 16 | 30 | — | — | — | 18 | — | 22 | 30 |
| 24 a | — | — | 16 | — | — | — | — | — | — | — | — | — |
| b | — | — | 16 | — | — | — | — | — | — | — | — | — |
| 25 a | 105 | 70 | — | 135 | 200 | — | — | — | 90 | — | 270 | 250 |
| b | 18 | 25 | — | 40 | 60 | — | — | — | 11 | — | 15 | (15) |
| c | — | — | 150 | — | — | — | — | — | — | — | — | — |
| 26 | 22 | 25 | 22 | 22 | 30 | — | 17 | — | 13 | — | 30 | 30 |
| 27 | 240 | 255 | 255 | 240 | 255 | 145 | 197 | 223 | 220 | 305 | 360 | 380 |
| 28 | 170 | 180 | 185 | 150 | 175 | 95 | — | — | 155 | 215 | 250 | 280 |
| 29 | 87 | 76 | 95 | 90 | 90 | 40 | 64 | 90 | 82 | 125 | 140 | 155 |
| 30 | 145 | 150 | 180 | 145 | 165 | 68 | 100 | 165 | 75 | 75 | 230 | 200 |
| 31 | 240 | 215 | 280 | 240 | 240 | 110 | 168 | 290 | 300 | — | 820 | 1 050 |
| 32 | 395 | 400 | 425 | 395 | 440 | 150 | 305 | 500 | 280 | 535 | 620 | 640 |
| 33 | 125 | 120 | 125 | 115 | 130 | 55 | — | 140 | 110 | 165 | 190 | (200) |
| 34 | 20 | 25 | 22 | 22 | 20 | 9 | 18 | 18 | 32 | 38 | 50 | 40+ |

* Maximum girth posterior to anus PEM 1517/68–560 mm; PEM 1520/85–600 mm; PEM 1517/97–660 mm; PEM 1517/95–1 000 mm.

** Measured by E. A. Fearnhead. *** Measured by E. Bigalke.

( ) Denotes approximate measurement.

The tooth counts of the three neonatal animals PEM 1520/32, PEM 1520/33 and the calf stranded in 1970 were:

$\frac{39-39}{40-40}$, $\frac{43-43}{40-40}$ and $\frac{41\,(+?)-41}{—\quad —\quad 38}$ respectively.

The first two counts were obtained by dissection and the last by radiography. The range in the number of teeth in eight specimens from southern Africa (Fraser, 1950c; Best, 1969; present study) is 37–43 in each upper jaw and 37–40 in each lower jaw, with means of 39,5 and 38,5 respectively.

## BIOLOGY

*Age determination:* Teeth from four specimens were sectioned for estimating their age.

The dentine of PEM 1520/32 and PEM 1520/33 was entirely prenatal and measured 0,45 mm and 0,40 mm respectively in thickness at the apex of the pulp cavity. The absence of any neonatal line suggests that these animals were either full-term foetuses or that they died almost immediately after birth.

The pulp cavities of PEM 1517/68 and PEM 1520/85 were occluded. In the former animal at least seven dentine layers were visible, but much of the tooth was unreadable. The prenatal dentine was 0,30 mm near the original apex of the pulp cavity. The tips of the teeth were worn.

The crowns of the teeth of PEM 1520/85 were worn extensively. Ten layers had been deposited in the dentine before secondary dentine had filled the pulp cavity.

The rate of dentine layer deposition is uncertain. Kasuya *et al.* (1974) estimated that one layer is deposited annually in Japanese specimens. Perrin *et al.* (1976) suggested that in the eastern Pacific two layers are deposited in the first year. However, they were undecided about the deposition rate in succeeding years, but suggested that probably one layer is deposited annually.

*Growth and development:* The mean length at birth in southern African *S. attenuata* is uncertain. The umbilicus of the 0,89 m long calf stranded in 1970 was partially healed, indicating that the calf was newborn. As suggested above there is some doubt whether PEM 1520/32 (0,85 m in length) and PEM 1520/33 (0,83 m in length) were neonatal animals, though the absence of any attached umbilical cord in either animal suggests that birth had occurred. The lengths of these calves are intermediate between mean lengths recorded elsewhere on large samples. The mean length at birth was estimated at 0,89 m in Japanese *S. attenuata* (Kasuya *et al.*, 1974) and 0,825 m in eastern Pacific animals (Perrin *et al.*, 1976).

The maximum length recorded in the present material was 2,20 m for the physically mature male PEM 1520/85. The 2,16 m long male, PEM 1517/68, was approaching physical maturity; the ephiphyses on vertebrae T7–Cd12 were partially fused to their centra. The longest female was 2,145 m and physically mature (Best, 1969). These lengths are comparable to those of specimens from the Pacific where male *S. attenuata* attain maximum lengths of 2,26–2,34 m, and the females are slightly shorter with a maximum length of 2,20 m (Perrin *et al.*, 1976).

Total and partial body masses for five southern African *S. attenuata* are provided in Table 115. Gambell *et al.* (1975) at 21° 42′S, 55° 25′E collected a 1,905 m male *S. attenuata* weighing 79,4 kg.

*Reproduction:* No reproductive data for female *S. attenuata* from the SE coast were collected. Best (1969) reported that the female stranded at Durban in 1964 was anoestrous, non-lactating and had about 16 corpora in the left ovary and none in the right. The only calf for which the date of birth is available stranded at Durban in November (Table 109). Reproductive data for eastern Pacific female *S. attenuata* have been compared with those for Japanese specimens by Perrin *et al.* (1976).

Reproductive data for five male *S. attenuata* from the SE coast are provided in Table 116. Comparison with data for males in the eastern Pacific (Perrin *et al.*, 1976) suggests that none of

Table 115:

Total and partial body mass and intestine length (m) for five *Stenella attenuata*, five *Lagenodelphis hosei* and three *Sousa plumbea* from the SE coast of southern Africa. Total mass is in kg, partial mass is a percentage of total mass.

| Catalogue Number | Total length (mm) | Total mass (kg) | Blubber | Meat | Heart Lung & Trachea | Heart | Liver | Kidneys | Intestine length (m) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| *S. attenuata* | | | | | | | | | | |
| Nov. 1970 | 890 | 7,5 | 31,3 | 12,5 | — | — | — | — | — | Neonate. |
| PEM 1520/84 | 1 820 | 55,4 | 14,0 | — | 4,6 | 0,54 | — | — | 15,8 | |
| SAM 38869 | 2 135 | 93,0 | 14,1 | 40,0 | — | — | — | — | — | Collected at sea. |
| PEM 1517/68 | 2 160 | 80,8 | 15,7 | 38,8 | — | — | — | — | — | |
| PEM 1520/85 | 2 200 | 83,9 | 13,6 | 40,0 | 3,2 | 0,35 | — | — | 20,6 | |
| *L. hosei* | | | | | | | | | | |
| PEM 1520/45 | 1 617 | 43,1* | — | — | — | — | — | — | — | Collected at sea. |
| PEM 1517/93 | 2 255 | 129,3 | 13,8 | 44,6 | — | — | — | — | — | Collected at sea. |
| 17.12.73 | 2 320 | 145,2 | — | — | — | — | — | — | — | Collected at sea. |
| SAM 36322 | 2 360 | 163,3 | 14,9 | 38,3 | — | 0,55 | 1,67 | 0,70 | — | Collected at sea. |
| SAM 36323 | 2 640 | 208,7 | 13,6 | 46,4 | 2,0 | 0,43 | — | 0,39 | — | Collected as sea. |
| *S. plumbea* | | | | | | | | | | |
| PEM 1515/77 | 970 | 8,0 | 24,0 | 13,7 | 3,7† | 0,75 | 2,0 | 0,94 | — | Neonate. |
| PEM 1515/76 | 1 080 | 15,6 | 23,8 | 12,2 | 5,0† | 0,77 | 1,9 | 1,20 | — | Neonate. |
| PEM 1517/95 | 2 790 | 284 | 20,6 | 41,2 | 2,6† | 0,72 | — | — | — | |

* Two days before death.

† Anterior part of trachea excluded.

TABLE 116:

Reproductive data for five male *Stenella attenuata*, two *Lagenodelphis hosei* and four *Sousa plumbea* from the SE coast of southern Africa.

| Catalogue Number | Total length (mm) | No. of dentine layers | Testis dimensions (mm) |  | Testis mass (g) |  |  | Mean Tubule diam. ($\mu$) | Comments |
|---|---|---|---|---|---|---|---|---|---|
|  |  |  | Left | Right | Left | Right | Total |  |  |
| *S. attenuata* |  |  |  |  |  |  |  |  |  |
| (Nov. 1970) | 885 | 0 | 35 × 7 | 25 × 8 | 0,9 | 0,75 | 1,65 | 20 | Neonate |
| PEM 1520/84 | 1 820 | — | 110 × 22 | 100 × 25 | 35 | 30 | 65 | 47 |  |
| PEM 1517/81 | 1 980 | — | *108 × 18 | 93 × 16 | 13 | 12,8 | 25,8 | 38 |  |
| PEM 1517/68 | 2 160 | 7+ | 178 × 45 | 178 × 45 | 91 | 75 | 166 | — | No sperm in epididymis |
| PEM 1520/85 | 2 200 | 10+ | — | — | 121 | 119 | 240 | — | No sperm in epididymis |
| *L. hosei* |  |  |  |  |  |  |  |  |  |
| PEM 1520/45 | 1 617 | — | *75 × 11 | 70 × 12 | 6,0 | 5,9 | 11,9 | — | Immature |
| SAM 36323 | 2 640 | — | 400 × 80 | 410 × 85 | 1 210 | 1 280 | 2 490 | — |  |
| *S. plumbea* |  |  |  |  |  |  |  |  |  |
| PEM 1515/77 | 970 | 0 | 23 × 9 | 23 × 9 | 1,0 | 1,0 | 2,0 | 51 | Neonate |
| PEM 1515/76 | 1 080 | 0 | 37 × 10 | 36 × 10 | 2,5 | 2,6 | 5,1 | 42 | Neonate |
| PEM 1517/97 | 2 710 | 11+ | 190 ×— | 190 ×— | — | — | 285 | — | Decomposing |
| PEM 1517/95 | 2 790 | 11+ | 220 × 80 | 220 × 80 | 325 | 325 | 650 | — | Decomposing |

* side unknown

the present animals was sexually mature though PEM 1517/68 and PEM 1520/85 were probably pubertal. In the eastern Pacific males there was considerable variation in the testis mass of sexually mature animals (*c*.300g–2 400 g); onset of sexual maturity began at lengths of about 1,95 m and the average length of sexually mature males was 2,01 m.

*Food and feeding:* Stomachs from five specimens were examined; two of these were empty.

The stomach of PEM 1517/81 contained three upper and four lower *Oregoniateuthis* beaks, otoliths from 53 *Symbolophorus* cf. *veranyi*, four unidentifiable myctophids, one unidentified fish and a juvenile balistid fish (31 mm TL). Two pairs of otoliths in the stomach of PEM 1517/68 were tentatively referred to *Trichiurus* sp. and *Ariosoma* sp. The stomach of PEM 1520/85 contained four upper and six lower *Oregoniateuthis* beaks. Otoliths from three fish and a few squid beaks were collected from the stomach of SAM 38869 but were not reexamined for this study. A mass of small fish bones and one squid beak were found in the stomach of SAM 35515 (Best, 1969).

In the eastern Pacific the offshore form *S. attenuata* feeds predominantly upon epipelagic fish and squids, including exocoetids, scombrids, stromateoids myctophids and ommastrephids, and on relatively few mesopelagic species (Fitch and Brownell, 1968; Perrin *et al.*, 1973). However, the stomachs of two specimens captured further west and the stomach of a specimen from Hawaii contained predominantly mesopelagic fishes and squids.

The presence of the epipelagic myctophid genus *Symbolophorus* in one of the southern African specimens suggests that this species may feed in surface waters in this region.

*Parasites:* External parasites were absent on four specimens examined. A total of 17 *Xenobalanus globicipitis* were found on the trailing edge of the flukes of PEM 1520/85.

A few cestode cysts *(Phyllobothrium* sp?) were seen in the blubber of SAM 38869 and PEM 1520/85, a few larger cestode cysts *(Monorygma* sp?) were found in the perineal region of both these specimens and a single large cyst occurred in the mediastinum of SAM 38869.

The stomachs of PEM 1517/68 and PEM 1520/85 contained a few nematodes, in the latter specimen identified as *Anisakis ? simplex*. A few specimens of *Orthosplanchnus ? elongatus* Osaki, 1935, were collected from the intestine of PEM 1520/85.

The bile duct of PEM 1520/85 contained numerous specimens of the trematode *Zalophotrema pacificus* Dailey and Perrin, 1973. The bile duct of PEM 1520/84 also contained specimens of *Z. pacificus* together with another trematode *Campula rochebruni* (Poirier, 1886). Both of these trematodes have been recorded from *S. attenuata* in the eastern Pacific (Dailey and Perrin, 1973).

*School size:* The estimated number of individuals in seven schools sighted off the SE coast (Tables 109, 110) ranged from 20 to between 200 to 300, the average being about 100. Gambell *et al.* (1975) sighted ten schools in the SW Indian Ocean which contained between 25 and 200 individuals, the average being about 45.

In Japanese waters the average estimated size of eight schools was about 33 (range 5–50) (Miyazaki *et al.*, 1974). However, the size of nine schools taken in the dolphin drive fishery off Japan was considerably greater, averaging 277 individuals per school (range 60–1 381) Kasuya, (1976). In the eastern Pacific the offshore population forms schools consisting of a few to several thousand individuals. The inshore population however forms smaller shcools, usually containing fewer than 100 individuals (Perrin, 1975a).

### Distribution and migration

Spotted dolphins, closely related or conspecific with *S. attenuata* have been recorded throughout the tropical and occasionally in warm temperate regions of the North Atlantic. Populations of spotted dolphins referred to *S. attenuata* have been described from widespread localities throughout the Indo-Pacific region (Perrin, 1975a). In the eastern Pacific a coastal form occurs from the Gulf of California to northern Peru and an offshore form extends to about 145°W, decreasing in latitudinal distribution westwards (Perrin, 1975b). By comparison with the sea surface temperatures figured by Evans (1976), the distributional limits of *S. attenuata* in this region are seen to match the 26°C mean annual isotherm.

In the SW Indian Ocean Dussumier in April 1828 at 32°S, 51°E (Arvy, 1972) collected a dolphin which Perrin (1975a) suggested was a spotted dolphin. In the same region Gambell *et al.* (1975) sighted between 20°–35°S and 40°–67°E ten schools referred to *S. attenuata* and collected a specimen from one of these. These authors suggested that *S. attenuata* was restricted to water with a surface temperature of 22°C or more.

The distribution of sight records and strandings on the SE coast of southern Africa (Fig. 41) does suggest that this species is restricted to warmer water. Strandings excluded, all records are beyond the 200 m isobath in Agulhas Current waters where sea surface temperatures exceed 22° C. There are too few data to indicate whether *S. attenuata* extends its distribution further south during the warmer months of the year though Miyazaki *et al.* (1974) have shown that the population of *S. attenuata* on the coast of Japan shifts up to 13° of latitude seasonally with the annual boundary fluctuation of the warm Kuroshio Current.

## ***Stenella longirostris*** (Gray, 1828)
## Spinner Dolphin

*Delphinus longirostris* Gray, 1828: 1 (holotype, skull, Rijksmuseum van Natuurlike Historie, Leiden, RMNH 8676; type locality, unknown).
*Prodelphinus longirostris* Sclater, 1901: 208; FitzSimons, 1920: 225.
*Stenella longirostris* Roberts, 1951: 230; Ellerman, Morrison-Scott and Hayman, 1953: 329; Best, 1971: 6.

### RECORDS AND MATERIAL

There are possibly three records of *S. longirostris* from southern Africa, but as some doubt as to their provenance exists, the occurrence of this species on the SE coast still requires confirmation from further material.

Between 1825 and 1838 a skull of this species was sent to the Rijksmuseum van Natuurlike Historie, Leiden (RMNH 21.723) from the Cape (Colony) (Van Bree, 1971b). As pointed out by Barnard (1954) it is quite possible that this skull originated from the Indian Ocean or farther east and may have acquired its 'Cape' status during trans-shipment *en route* to Europe. Skull measurements of this specimen have been given by van Bree (1971b).

A skull, without data, examined in 1969 in the museum of the Zoology Department, University of Natal, Pietermaritzburg and now in the South African Museum, Cape Town (SAM 37129) was referred to *S. longirostris* by Best (pers. comm.). It seems most unlikely that this skull, from a species which is not usually well represented in collections, should have been bought or exchanged by the Zoology Department purely for teaching purposes. It is far more likely that it originated from the southern African coast, perhaps from northern Natal or Mocambique. This skull was not examined by the author for this study.

The third record is a newborn female calf 0,85 m in length (PEM 1520/31) examined by the author at the ORI, Durban on 7 December 1976. The calf was found in the specimen freezer with two neonatal *S. attenuata* (PEM 1520/32 and PEM 1520/33). The origin of this calf is unknown, but it is almost certain that it came from the Natal coast, after stranding. This specimen was identified on external and skeletal features outlined below.

### SPECIFIC STATUS AND CHARACTERS

After a study of large series of spinner dolphins, Perrin (1975a) concluded that a single species referred to *Stenella longirostris* Gray, 1828 (van Bree and Perrin, 1977) occurs in the Pacific. Perrin *et al.* (1977b) have shown that *S. longirostris* and a closely related species *S. cly-*

*mene* (Gray, 1850) occur sympatrically in the Atlantic. These species differ in colour pattern, external proportions and skull measurements.

Perrin (1975a) recognized four unnamed subspecies in the eastern Pacific. These differ from one another in skull proportions or colour patterns and have been referred to as Hawaiian, Costa Rican, whitebelly and eastern spinner dolphins.

*S. longirostris* is characterized by a long snout (*c*.7,5–10,0% of total length) and correspondingly long rostrum (61–67% of CBL) which is narrow at its base (*c*.17–21% of CBL). The number of teeth ranges from 47 to 61 and 45 to 59 in the upper and lower jaws respectively. A shallow groove is present on each side of the palate. The premaxillae on the rostrum are depressed dorsally and fuse in the midline in physically mature animals. The temporal fossae are small and round. There are 70 to 76 vertebrae (True, 1889; van Bree, 1971b; Perrin, 1975a).

### DESCRIPTION

The illustration of *S. longirostris* in Fig. 26 is based on a photograph of a 1,78 m male whitebelly spinner dolphin from the eastern Pacific (Perrin, 1972, Fig. 19). Excepting references to PEM 1520/31, the following description is based on eastern Pacific animals described by Perrin (1972, 1975a).

The body of *S. longirostris* is slender and streamlined. The melon is slightly depressed dorsally, tapering anteriorly to an acute apex and meeting the dorsal surface of the snout abruptly antero-laterally. The dorsal fin is high, erect, falcate (in Hawaiian specimens), becoming triangular in adult male whitebelly spinners and canted forward in adult male eastern spinners. A pronounced post-anal ventral hump forms in the adult male whitebelly and eastern spinners.

External measurements for PEM 1520/31 are provided in table 114.

In adults the entire dorsal surface of the head and body, the caudal peduncle posterior to the anus and the appendages are dark grey. A broad dark band extends from the eye to the flipper insertions and a thin, dark stripe joins the eye and the apex of the melon. In eastern spinners the dark dorsal field generally extends to the ventral midline leaving discrete white axillary and genital patches. In whitebelly spinners, these patches are confluent but the dorsal field is extended ventrally as spots (fig. 26). In Hawaiian spinners the dorsal field extends to mid-depth of the body. Despite some *postmortem* darkening in PEM 1520/31 the lower edge of the dorsal cape was clearly visible above the eye, the anterior edge of the eye-to-flipper band contrasted strongly with the paler gular region and the ventral surface from the lower jaws to the anus and to near mid-depth of the body was whitish in colour. The colour pattern of this specimen was similar to that illustrated by Perrin (1972, Fig. 24).

The skull of PEM 1520/31 is not sufficiently developed to show some of the characteristic features of *S. longirostris*. The rostrum is 53,5% of CBL (230 mm) in length and 16,1% of

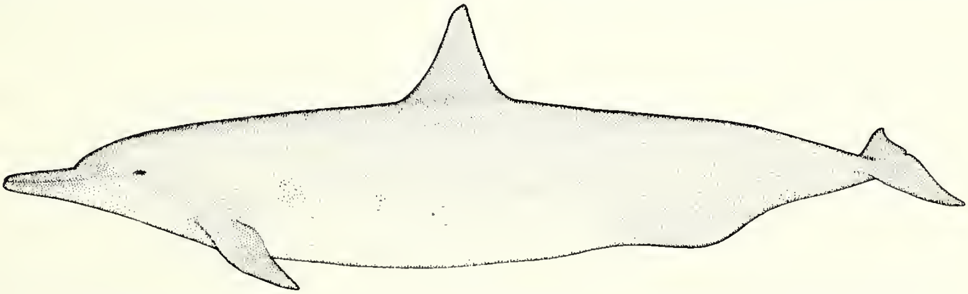


Fig. 26. Male *Stenella longirostris*, 1,78 m in length, from the eastern Pacific (after Perrin, 1972).

CBL in width at its base. The dorsal surfaces of the premaxillae in the proximal half of the rostrum are flattened and depressed almost to the level of the adjoining maxillae. This feature distinguished this skull at once from those of two young *S. attenuata*, PEM 1520/32 and PEM 1520/33. The absence of palatal grooves was ascribed to the extreme youth of this specimen. Dissection of the right upper and lower jaws showed 51 and 48 teeth respectively. These teeth were of similar length to those of the two young *S. attenuata* PEM 1520/32 and PEM 1520/33, but were noticeably more slender.

Variation in the skull and post cranial skeleton of *S. longirostris* has been described in detail by Perrin (1975a).

The vertebral formula of PEM 1520/31 was C7 T15 L18 Cd32 = 72.

### BIOLOGY

*Age determination:* The teeth of PEM 1520/31 consisted almost entirely of prenatal dentine, capped externally by a layer of enamel and lined internally by a very thin layer of nodular translucent dentine. In the section examined the prenatal dentine was 0,30 mm thick at the apex of the pulp cavity and the translucent dentine was about 10 μ thick.

Perrin *et al.* (1977a) proposed that one and one-half layers are deposited in the first year in the eastern spinner dolphin but were uncertain about the rate of formation in subsequent years.

*Growth and development:* From the appearance of the teeth, PEM 1520/31 died soon after birth, at a length of 0,825 m. This is greater than the average length at birth in the eastern spinner dolphin (0,77 m), though the largest foetus recorded was 0,84 m in length (Perrrin *et al.*, 1977a).

Adult *S. longirostris* in the eastern Pacific attain lengths of 1,9–2,2 m (Perrin, 1975a).

*Reproduction:* The ovaries of PEM 1520/31 each measured 18 × 7 × 4 mm and weighed 0,20 g.

Reproduction in the eastern spinner has been described by Perrin *et al.* (1977a). Females and males attain sexual maturity at about 1,65 m and 1,70 m in length respectively.

*Food and feeding:* Myctophids formed 73% of all fish and 70% of the total number of prey items in 47 specimens of *S. longirostris* from the eastern Pacific (Perrin *et al.*, 1973) and 91% of all items in five specimens of *S. longirostris* from the same region (Fitch and Brownell, 1968). Gonostomatids and *Bregmaceros* sp. were numerically less important food items. Data on the depth distribution of major prey items in both studies suggested that these *S. longirostris* fed on mesopelagic species at a depth exceeding 250 m below the surface.

### DISTRIBUTION AND MIGRATION

*S. longirostris* is a warm water species occurring in the tropical waters of the Pacific, Indian and Atlantic Oceans (Perrin, 1975a: Perrin *et al.*, 1977b). In the eastern Pacific, as pointed out by Evans (1976), the distributions of *S. longirostris* and *S. attenuata* are very similar and both are bounded approximately by the 26 °C average annual isotherm.

A recent record of *S. longirostris* from the western Indian Ocean is based on a specimen found dead near Dar-es-Salaam Harbour in 1973 (Howell and Pearson, 1977).

## Genus *LAGENODELPHIS* Fraser, 1956

*Sarawak Mus. Journ.*, 7 (8, n.s.): 496; type species *Lagenodelphis hosei* Fraser, 1956, by original designation.

These are medium-sized dolphins attaining lengths of up to 2,65 m. The beak is well-defined but very short (1,0–2,5% of total length). There is a single dark lateral stripe between the eye and the anus. The cranium is broad and rostrum width at base is 48–55% of rostrum length. The premaxillae are depressed dorsally on the rostrum which is flattened. A longitudinal groove is present on each side of the palate. The mandibular symphysis is short and keeled ventrally. There are 38 to 44 teeth in each jaw.

A single species *Lagenodelphis hosei* Fraser, 1956 is recognized at present.

### ***Lagenodelphis hosei*** Fraser, 1956
### Fraser's Dolphin

*Lagenodelphis hosei* Fraser, 1956: 496 (holotype, skeleton, BM 1895.5.9.1; type locality, Lutong River, Baram, Sarawak); Perrin, Best, Dawbin, Balcomb, Gambell and Ross, 1973: 345.

#### RECORDS AND MATERIAL

Data for seven specimens and six sight records of *L. hosei* from the SE coast of southern Africa are provided in Tables 109 and 110 respectively, and their localities mapped in Fig. 42.

#### SPECIFIC STATUS AND CHARACTERS

Fraser (1956) described *Lagenodelphis hosei* on a single specimen collected in Sarawak prior to 1895. No further material became available until 1971 when specimens collected in the eastern Pacific, Australia, southern Africa (Perrin *et. al.*, 1973) and Japan and Taiwan (Tobayama *et al.*, 1973) were referred to this species on the basis of the close similarity in skeletal morphology of this material with that of the type specimen.

Individual variation in cranial and external proportions other than those characteristic for the species (as given for the genus above) is small in the sample of 12 specimens (including three new specimens reported on here) which are presently known from the Indo-Pacific region (Perrin *et al.*, 1973) and are considered to represent a single species.

Caldwell *et al.* (1976) briefly reported on the first three records of *Lagenodelphis* from the Atlantic based on captures off St. Vincent, Lesser Antilles. A more detailed study (in progress) by these authors should indicate whether the Atlantic and Indo-Pacific forms are conspecific or not.

#### DESCRIPTION

A 2,64 m long adult male, SAM 36323, is illustrated in Fig. 27.

The body of *L. hosei* is robust, slightly compressed laterally anterior to the dorsal fin and becomes increasingly compressed caudally. The melon is full and expanded anteriorly where it tapers to a well-defined apex forming a distinct broad and stubby snout (1,1–2,1% of total length). The dorsal fin is small (height 6,2–8,3% of total length), triangular and erect or slightly falcate and set at midlength of the body. The flippers are short (8,4–12,2% of total length), evenly convex anteriorly and slightly concave posteriorly and taper to a pointed apex. The flukes are moderate in width (18,8–24,1% of total length), narrow antero-posteriorly, crescentic and have a distinct caudal notch.

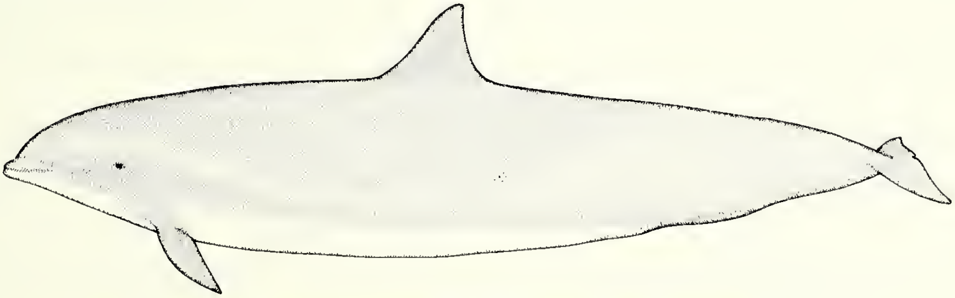


Fig. 27. Adult male *Lagenodelphis hosei*, 2,64 m in length, from Natal waters (SAM 36323).

External measurements of ELM 938 and PEM 1520/45 are provided in Table 114.

The dark greyish blue dorsal pigmentation extends from the apex of the melon covering the dorsal surface of the body to about three quarters of body length from the snout and reaching its most ventral extension anterior to the dorsal fin. The lighter bluish grey dorsal and lateral pigmentation covers the entire dorsal and lateral surfaces. Its ventral margin runs from the lower jaw in a curve to the flipper insertion and from the axilla to the anus. The ventral surface is white, in life suffused with pink. Both surfaces of the flukes and flippers are dark grey.

A characteristic single dark grey stripe runs from the edge to the anus near the ventral margin of the lighter grey lateral pigmentation and almost parallel to the darker dorsal pigmentation anteriorly. A dark grey stripe connects the flipper insertion and the lower jaw anterior to the angle of the gape. Thin dark stripes from the apex of the melon to the blowhole and to a dark patch around the eye form a bridle. A dark patch on the tip of the upper jaw is matched by a similar patch on the lower jaw tip and is connected to the melon by a thin mid-dorsal line on the snout.

The pigmentation of the juvenile PEM 1520/45 supports the observations of Perrin *et al.* (1973) that variation in the intensity and extent of colour pattern components appears to be related to age. In this juvenile the dorsal colour was brownish grey. The paler lateral pigmentation was very light grey against which the lateral stripe was barely discernible anterior to the dorsal fin and absent posteriorly.

The rostrum of the skull is broad at its base, narrowing anteriorly and tapering abruptly distally. The premaxillae are flattened dorsally on the rostrum. They are fused in the dorsal midline in ELM 938, but those in PEM 1520/92 show no evidence of having been fused in life.

Posteriorly the mesial wall of each palatal groove and the adjoining lateral surface of each palatine are almost vertical and meets the midventral surface of the rostrum at right angles imparting a reactangular appearance to this part of the skull. In lateral view the antorbital structure is robust formed by the thickened lateral margin of the maxilla, the frontal and the attenuated lateral edge of the jugal and presents an almost planar antero-lateral surface.

Skull measurements for PEM 1520/92 and ELM 938 are provided in Table 112.

The cervical vertebrae and first few thoracic vertebrae are missing in PEM 1520/92 and ELM 938; the remaining vertebrae are T11 + L22 Cd34(+1) and T11 + L22 Cd29(+4 or 5) respectively. The total number of vertebrae in two South African specimens was 78 (SAM 36323) and 78(+1) (SAM 36322), 79 in an eastern Pacific specimen, (Perrin *et al.*, 1973), 80 + 2 in the type specimen and 81 in a specimen from Japan (Tobayama *et al.*, 1973).

## BIOLOGY

*Age determination:* Teeth from two physically mature specimens, PEM 1520/92 and ELM 958, were examined for estimating their age. These teeth closely resembled those of other delphinids such as *Delphinus* and *Stenella* in their external and internal structure. The uniform prenatal dentine was 0,45 mm and 0,55 mm thick near the apex of the neonatal pulp cavity in ELM 938 and PEM 1520/92 respectively and was delineated from the postnatal dentine by a translucent neonatal line approximately 25 μ in width.

The layering in the postnatal dentine of ELM 938 was indistinct. At least seven layers were counted in the crown of the tooth through approximately two thirds of the dentine thickness. The dentine forming the root of the tooth was uniformly translucent and growth increments were indicated by thin refractive lines. Fourteen such lines were counted in this tooth. The pulp cavity consisted of a series of narrow chambers enclosed by secondary dentine but was open at the tooth base.

The tooth of PEM 1520/92 proved to be unreadable. Very indistinct layering was present in the tooth crown and the root dentine was entirely translucent. The pulp cavity was closed.

*Growth and development:* The length at birth is unknown. The 1,10 m free-swimming calf is the smallest specimen on record (Perrin *et al.*, 1973).

The maximum length recorded was 2,64 m in the male SAM 36323 and the female ELM 938. Both of these animals and the 2,36 m long female SAM 36322 were physically mature.

Total and partial body masses for four southern African specimens are provided in Table 115. A 2,35 m long male from Japanese waters weighed 129 kg. The intestine of this specimen was 13,3m in length (Tobayama *et al.*, 1973).

*Reproduction:* PEM 1517/93, a female 2,255 m in length, was sexually immature. SAM 36322, 2,36 m in length, carried a 0,11 m long foetus in the left horn of the uterus; she was not lactating.

The 1,10 m calf from the eastern Pacific was collected in January (Perrin *et al.*, 1973). The presence of numerous calves and at least one very small calf in the schools sighted off the SE coast on 8 February and 17 February 1971 respectively may indicate that calving occurs in the summer months.

Data on the testes of two male *L. hosei* are given in Table 116. Though those of SAM 36323 have not been examined histologically, their total mass compared with that in other delphinids suggests that this specimen was sexually mature. The testis masses of the 2,35 m male reported by Tobayama *et al.* (1973) were 990 g (left) and 260 g (right).

*Food and feeding:* The stomach contents of three specimens collected at sea were identified superficially during dissection; the preserved material was not examined for this study. The stomachs of SAM 36323 and PEM 1517/93 contained several fish otoliths and eye lenses. The remains of fish, squid and crustaceans (possibly *Gnathophausia*) were collected from the stomach of SAM 36322.

Tobayama *et al.* (1973) collected 479 fish otoliths and the beaks from seven squids from a specimen from Japanese waters. The fish included morids (2,3% of total fish), *Polyipnus* (Sternoptychidae) (15,7% of total fish) and *Ichthyococcus* (Gonostomatidae) (72,4% of total fish). These fish rarely rise to within 200 m of the surface (Fitch and Brownell, 1968) which suggests that this specimen had been feeding to at least that depth. In contrast to this suggestion, the school from which SAM 36323 was collected was observed feeding at the surface in association with large numbers of feeding terns (*Sterna macrura* or *S. hirundo*).

*School size:* SAM 36322, SAM 36323 and PEM 1517/93 were collected from schools estimated at 100, 1 000 and 200 to 300 individuals. Other school sizes are given in Table 110, ranging from 7 or 8 to 300–400. Four of seven schools exceeded 100 individuals. Perrin *et al.* (1973) noted a school of approximately 400 individuals in the central Pacific.

### DISTRIBUTION AND MIGRATION

This species has been recorded from a number of widespread localities in the tropical oceanic waters of the Pacific (Perrin *et al.*, 1973, Tobayama *et al.*, 1973) and the tropical Atlantic (Caldwell *et al.*, 1976).

The distribution of *L. hosei* on the SE coast of southern Africa is shown in Fig. 42. Excluding three strandings, localities of specimens or sight records are all over water of more than 1 000 m in depth and appear to be associated with the warm water of the Agulhas Current. Eight of all 11 southern African records are from the Natal region. During approximately 10 000 km steamed in good sighting conditions between 20° S–42° S and 30° E–67° E from 24 November 1973 to 3 February 1974, Gambell *et al.* (1975) saw one group only of *L. hosei*. This was within the previously known range and the authors suggested that this species may have a localized distribution in the SW Indian Ocean.

There are insufficient data to show whether *L. hosei* occurs seasonally in this region. The dates of the eight sight records or captures at sea (December, January and February) reflect the times when whale marking cruises were undertaken and do not confirm the absence of the species at other times of the year. The three strandings also occur in the same months, perhaps indicating that this species does move into the region in the warmer summer months.

### Genus *SOUSA* Gray, 1866

*Proc. zool. Soc. London,* 1866: 213; type species *Sousa lentigenosus* Gray, 1866.

These are medium-sized dolphins attaining lengths of up to 3,1 m. The body is robust, the melon is well-developed with a distinct apex and the snout is long (6–8% of total length) and slender. The dorsal fin is low, basally forming an elongate ridge which may be thickened. The flippers are broad with a rounded apex.

The rostrum of the skull is long (57–67% of CBL) and compressed laterally; there are no palatal grooves. The pterygoid hamuli are separated in the midline. A broad area of frontal bone is exposed between the maxillae and the transverse supraoccipital crest on the vertex of the skull. There are 26 to 38 teeth in each jaw. The mandibular symphysis is long (18–27% of CBL). There are 48 to 55 vertebrae.

The Old World genus *Sousa* has been distinguished from the similar South American genus *Sotalia* on the structure of the tympanic and periotic bones (Kellogg, *in* Fraser, 1966; Kasuya, 1973). The five nominal *Sousa* species currently recognized occur in tropical and warm temperate coastal and estuarine waters. These species are: *S. teuszii* (Kukenthal, 1892) of West Africa; *S. plumbea* (Cuvier, 1829) and *S. lentigenosa* (Owen, 1866) of the western and northern shores of the Indian Ocean; *S. chinensis* (Osbeck, 1765) of China; *S. borneensis* (Lydekker, 1901) of the East Indies and north Australian coast.

Owing to the lack of comparative material there is considerable doubt concerning the specific status of these forms (Pilleri and Gihr, 1972a), and the number of valid species may eventually be reduced to one, or two, as discussed below.

### ***Sousa plumbea*** (G. Cuvier, 1829)
### Humpback Dolphin

*Delphinus plumbeus* G. Cuvier, 1829: 288 (holotype, skull, Museum National d'Histoire Naturelle, no. *a*3053; type locality, Malabar, India).

*Sotalia lentigenosa* Sclater, 1901: 214; Roberts, 1951: 227 Ellerman, Morrison-Scott and Hayman, 1953: 330; Barnard, 1954: 31; Tietz, 1963: 68; Best, 1971: 7.

*Sousa plumbea* Davies, 1963a: 36; Anon, 1965: 57.

*Sousa plumbea/lentigenosa* Saayman, Bower and Tayler, 1972: 1; Saayman and Tayler, 1973: 993; Saayman and Tayler, 1979: 165.

#### RECORDS AND MATERIAL

Data for 16 specimens from the coast of southern Africa are provided in Table 117. Information on seasonality and school size for 59 sightings made by the author in eastern Cape waters between 1970 and mid-1978 are discussed below. Similar data for 126 sightings at Plettenberg Bay have been given by Saayman and Tayler (1973).

#### SPECIFIC STATUS AND CHARACTERS

The distinction between the species of *Sousa* is not very clear. With the exception of the lower tooth numbers in *S. teuszii*, the species are not distinguishable on their cranial morphology (Pilleri and Gihr, 1972a) and differences in external appearance are comparatively small and incompletely documented. A summary of these features for each species is given in Table 118 and is based on the recent review by Pilleri and Gihr (1972a) with additional data from other authors and the present material.

The relationship of *S. chinensis* (described from a single specimen) with the other species is unknown though the colour pattern resembles that of *S. borneensis*. The latter species differs from the group formed by *S. plumbea, S. lentigenosa, S. teuszii* and the southern African speci-

TABLE 117:

Records of *Sousa plumbea* from the coast of southern Africa.

| Catalogue Number | Sex | Total length (mm) | CBL (mm) | Date | Locality | Comments |
|---|---|---|---|---|---|---|
| SAM 1212 | — | — | 534 | 18.11.1896 | Muizenberg | Skull apparently found on beach (Sclater, 1901). |
| PEM 1496/63 | ♀ | — | 520 | 18.01.63 | Port Elizabeth | In captivity for two months (Tietz, 1963). |
| PEM 1496/64 | ♂ | — | 515 | 18.01.63 | Port Elizabeth | Captured with previous specimen. |
| SAM 35100 | ♀ | *c.* 2 440 | (541) | 18.01.63 | Port Elizabeth | Captured with previous specimens. |
| — | — | — | — | 1962 | Natal | Photograph in Davies (1962). |
| — | — | — | — | Oct. 1964 | Durban | Shark nets (Davies, 1963a). |
| ELM 30 | — | — | 561 | pre 1966 | East London? | Skull only. |
| PEM 1511/18 | — | — | — | Mar. 1967 | Klaasie's River Mouth | Mandible and teeth found on beach. |
| PEM 1514/37 | — | — | — | 6.01.69 | Seaview | Decomposed neonate. |
| ZMA 14.597* | — | 2 540 | 548 | 19.04.70 | nr. Gamtoos River Mouth | Decomposed. Originally PEM 1515/44. |
| PEM 1515/76 | ♂ | 1 080 | — | 14.10.70 | Cape Receife | Neonate. |
| PEM 1515/77 | ♂ | 970 | — | 17.10.70 | Cape Receife | Neonate. |
| PEM 1517/95 | ♂ | 2 790 | 564 | 20.07.72 | Mtunzini | Decomposing. |
| PEM 1517/97 | ♂ | 2 710 | 560 | 28.07.72 | Cape St. Francis | Emaciated. |
| — | — | — | (542) | pre 1977 | Gouritz River Mouth | CBL estimated from photos in PEM. |
| PEM 1520/65 | — | 1 010 | — | 11.06.77 | Cape St. Francis | Neonate? Examined Jul. 1977 |

( ) denotes approximate measurement.
* Zöologisch Museum, Amsterdam.

TABLE 118:

Comparison of characters for five *Sousa* species with those for southern African specimens of *Sousa*. Data are from Cadenat and Paraiso (1957), Lydekker (1901, 1909), Mitchell (1975), Pilleri and Gihr (1972, 1973/74), Tietz (1963) and the present study.

| Character | *S. chinensis* China | *S. borneensis* Malaysia N. Australia | *S. plumbea* N. Indian Ocean | *S. lentigenosa* N. Indian Ocean | *S. teuszii* West Africa | S. African specimens |
|---|---|---|---|---|---|---|
| Colour pattern | Milky white with pink fins. | Glossy white dappled with grey. | Bluish grey dorsally, white ventrally. | As for *S. plumbea* with overlay of spots. | Slate grey dorsally, paler grey ventrally. | Slate grey dorsally, paler ventrally. |
| Dorsal fin | No data. | Low, triangular; elongate basally. | Small, falcate, base elongate, ridged. | As for *S. plumbea.* | As for *S. plumbea.* Ridge up to 32% TL. | As for *S. plumbea.* Ridge up to 37% TL. |
| Dorsal and ventral ridges on caudal peduncle. | No data. | Poorly developed. | Well developed. | Well developed. | Well developed. | Well developed. |
| Number of teeth | $\frac{32-33}{31-32}$ | $\frac{29-37}{32-36}$ | $\frac{31-38}{31-37}$ | $\frac{31-36}{32-36}$ | $\frac{27-31}{26-30}$ | $\frac{30-38}{29-37}$ |
| Number of vertebrae | 51 | No data. | 49 – 51 | 49 – 51 | 52 – 53 | 48 – 55 |

mens in the form of the dorsal fin, the depth of the caudal peduncle and the colour pattern. To date very few specimens have been examined. If these features occur consistently in additional specimens of all ages, recognition of *S. borneensis* as a distinct species would be justified.

The presence of an overlay of dark grey spots appears to be the only character distinguishing *S. lentigenosa* from *S. plumbea* (Pilleri and Gihr, 1972a). Specimens identified as *S. lentigenosa* on the presence of spots have been recorded from the Persian Gulf and the southern Indian coast where they are sympatric with animals identified as *S. plumbea* (Pilleri and Gihr, 1972a; 1973/74). Though these authors maintain that *S. lentigenosa* is specifically distinct from *S. plumbea*, the presence or absence of spotting as a specific character should be treated with caution, particularly in view of variation in intensity and the ontogenetic development of spotting demonstrated in some other delphinids such as *Tursiops aduncus* (present study), and *S. attenuata* (Perrin, 1975a).

If the presence of spots is accepted as a valid diagnostic feature of *S. lentigenosa*, southern African specimens cannot be referred to this species, for spots were not present on any of these specimens (Tietz, 1963; present study) nor on any animal the author observed at close range at sea.

The southern African material is almost identical to that of *S. plumbea* from the northern Indian Ocean and is very similar to specimens of *S. teuszii* from West Africa. These two species differ primarily in the number of teeth of which the ranges barely overlap. Tooth counts in present material cover the range shown by *S. plumbea* and overlap slightly with those of *S. teuszii*. Differences in the vertebral counts in these two species should be treated cautiously since they are based on only three specimens of *S. plumbea* and two of *S. teuszii*. Six of the seven vertebral counts for the southern African material ranged from 48–51 (Table 113). The seventh count of 55 was given by Tietz (1963) for PEM 1496/64, but all but two of the lumbar vertebrae unfortunately are now missing, making a re-examination of this specimen impossible.

Comparison of available external measurements of one *S. plumbea*, four *S. teuszii* (Pilleri and Gihr, 1972a) and four southern African specimens (Table 114) indicated no differences of taxonomic significance.

The skull measurements of 20 *S. plumbea* and 11 *S. teuszii* provided by Pilleri and Gihr (1972a; 1973/74) are compared in Table 119 with data from Table 112 for ten southern African *Sousa*. Several of these measurements (nos. 9, 10, 13 and 37) show that the skull of *S. teuszii* is proportionately broader than that of *S. plumbea*, as indicated by Pilleri and Gihr (1972a), and that those of the southern African specimens are intermediate between these two species. The mean number of teeth, the lengths of the tooth rows and the lengths of the mandibular symphysis in southern African specimens however resemble those of *S. plumbea* more closely than those of *S. teuszii*.

On the present evidence southern African *Sousa* are considered to be conspecific with *S. plumbea* from the northern Indian Ocean and have been referred to that species in this report. The similarity between southern African *S. plumbea* and *S. teuszii* in all features except differing but overlapping tooth counts and the length of the mandibular symphysis raises some doubt regarding the specific status of the latter form and so it may be more correct to treat *S. teuszii* as a subspecies of *S. plumbea*. Rice (1977) suggested that *S. teuszii* could be regarded as a subspecies of *S. chinensis,* but for reasons discussed above, it is uncertain whether all the Indo-Pacific forms of *Sousa* are conspecific.

In 1936 Miranda-Ribeiro described *Stenopontistes zambezicus* based on a skull collected in the Zambesi district of Mozambique. This species was placed as a junior synonym of the rough-toothed dolphin *Steno bredanensis* (Lesson, 1828) by Ellerman *et al.* (1953) and other authors. Brownell (1975) re-examined the holotype of *Stenopontistes zambezicus* and identified it as a specimen of *Sousa plumbea*. His decision was criticized by Pilleri and Gihr (1976b) on

TABLE 119:

Comparison of skull measurements of 20 *Sousa plumbea* from the northern Indian Ocean, 10 *Sousa* sp. from southern Africa and 11 *S. teuszii* from West Africa. Condylobasal length (measurement 1) is in mm; other measurements are expressed as percentages of CBL. Measurement nos. except no. 37 are keyed to Table 6. Data sources are given in the text.

| Meas. No. | *S. plumbea* | | | *Sousa* sp. | | | *S. teuszii* | | |
|---|---|---|---|---|---|---|---|---|---|
| | Mean | Range | N | Mean | Range | N | Mean | Range | N |
| 1 | 516 | 456–574 | 20 | 543 | 515–564 | 8 | 490 | 439–518 | 11 |
| 2 | 60,7 | 57,8–66,7 | 20 | 62,7 | 61,4–64,0 | 8 | 59,5 | 57,6–61,9 | 11 |
| 3 | 19,9 | 18,4–22,5 | 18 | 21,3 | 20,4–22,1 | 8 | 22,8 | 22,0–23,7 | 7 |
| 5 | 9,5 | 7,7–10,9 | 19 | 9,2 | 8,6–10,1 | 8 | 9,5 | — | 1 |
| 6 | 6,4 | 5,0–8,1 | 19 | 6,2 | 5,7–7,1 | 7 | 6,6 | — | 1 |
| 7 | 68,5 | 64,8–74,1 | 20 | 68,9 | 63,1–71,0 | 8 | 64,4 | — | 1 |
| 8 | 68,3 | 63,8–71,0 | 11 | 72,7 | 71,1–74,9 | 8 | 68,0 | — | 1 |
| 9 | 34,9 | 32,3–38,4 | 18 | 36,6 | 35,5–38,2 | 8 | 40,2 | 39,0–41,4 | 7 |
| 10 | 39,5 | 36,0–43,6 | 17 | 41,7 | 40,1–44,2 | 7 | 43,5 | 41,9–45,0 | 7 |
| 13 | 39,2 | 36,0–41,4 | 19 | 41,6 | 40,2–43,8 | 8 | 43,6 | 52,5–44,6 | 7 |
| 14 | 15,6 | 13,9–17,2 | 19 | 16,4 | 15,1–17,1 | 8 | 17,4 | 16,5–18,5 | 7 |
| 16 | 36,3 | 32–38 | 13 | 34,3 | 30–38 | 10 | 28,5 | 27–30 | 11 |
| 17 | 36,5 | 31–38 | 13 | 34,5 | 32–38 | 10 | 29,2 | 27–31 | 11 |
| 18 | 53,8 | 50,9–55,9 | 16 | 53,7 | 52,8–54,9 | 7 | 51,0 | 49,4–52,9 | 6 |
| 19 | 53,9 | 51,3–55,8 | 16 | 53,3 | 51,5–54,6 | 8 | 50,6 | 49,0–52,2 | 6 |
| 22 | 34,5 | 31–36 | 16 | 32,9 | 30–37 | 11 | 27,8 | 27–29 | 10 |
| 23 | 34,2 | 31–37 | 16 | 32,6 | 29–36 | 12 | 27,8 | 26–30 | 10 |
| 24 | 51,9 | 49,1–55,3 | 13 | 50,6 | 49,3–52,8 | 8 | 48,7 | 45,6–50,2 | 6 |
| 25 | 51,9 | 49,1–55,3 | 14 | 50,1 | 48,9–51,3 | 8 | 48,1 | 44,6–50,9 | 6 |
| 28 | 84,0 | 82,1–87,9 | 15 | 85,3 | 83,7–86,6 | 8 | 84,0 | 82,0–86,6 | 6 |
| 29 | 16,2 | 14,9–17,5 | 15 | 16,6 | 16,2–17,2 | 8 | 17,7 | 16,9–18,7 | 6 |
| 30 | 24,3 | 21,7–26,8 | 15 | 25,1 | 22,9–26,6 | 8 | 20,2 | 18,2–23,5 | 6 |
| 31 | 19,5 | 17,0–22,2 | 19 | 22,1 | 19,6–23,3 | 8 | 20,5 | — | 1 |
| 32 | 15,4 | 13,1–18,1 | 20 | 15,9 | 15,3–17,4 | 8 | 19,7 | — | 1 |
| 33 | 6,7 | 5,5–8,3 | 18 | 6,6 | 4,9–7,8 | 8 | 7,6 | — | 1 |
| 37 ** | 1,55 | 1,32–1,80 | 19 | 1,51 | 1,43–1,57 | 8 | 1,34 | 1,29–1,38 | 6 |

** Measurement 37: Rostral length/zygometric width ratio.

the grounds that the skulls of *S. plumbea* and *S. lentigenosa* are indistinguishable, and that *S. zambesicus* could therefore belong to either species. On distributional grounds it is highly probable that Brownell was correct for now that the southern African material is referred to *S. plumbea* this is the only species of *Sousa* known to occur on the east coast of Africa. Further material from Mozambique waters is required to confirm Brownell's (1975) identification.

## DESCRIPTION

A 1,08 m male neonate PEM 1515/76 is illustrated in Fig. 28.

The body is robust, slightly compressed laterally anterior to the dorsal fin tip and increasingly compressed caudally. At all ages elongate low ridges are present on the dorsal and ventral margins of the caudal peduncle. The melon is moderate in size, slightly depressed dorsally and in profile slopes gradually anteriorly to a distinct apex; laterally the junction of the melon and the dorsal surface of the snout is indistinct. The snout is long (about 6,5–8% of total length) and slender. In two neonates nine or ten vibrissae were present on each side of the dorsal surface of the snout. The line of the gape is straight, terminating posteriorly in a short ventral curve a few centimetres anterior to the eye.

The dorsal fin is elongated and thickened basally (up to 40 mm in a neonate and 80 mm in

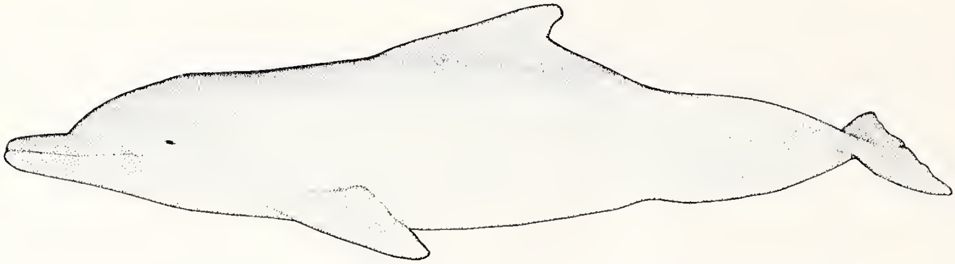


Fig. 28. Male neonatal *Sousa plumbea*, 1,08 m in length, from the eastern Cape (PEM 1515/76).

an adult male), becomes thinner dorsally and shortened, forming a small fin-like falcate structure which is set at about body midlength. The length of the basal ridge increases from about 25% of body length in neonates to 30–37% in adults. The total height of the dorsal fin varies from about 6–9% of body length.

The flippers are moderate in length (12–14% of body length), broad and rounded apically. The leading edge is smoothly convex and the trailing edge is angular. The flukes are broad, full and have a deep median posterior notch.

External measurements for four SE coast specimens are provided in Table 114.

The colour pattern of one adult specimen only was observed after it had been exposed to the sun and had become darkened. The appendages, the dorsal surfaces of the snout, head and back and lateral surfaces of the caudal peduncle were dark greyish black. This colour shaded gradually to the off-white colour of the ventral surface at about mid-depth of the body between the lower jaw and the anus. The colour pattern of this animal closely resembled that of an adult female figured by Tietz (1963).

The neonate PEM 1515/76 was perfectly fresh when examined and provided data on some of the more subtle pigmentation. The basic pattern (Fig. 28) was similar to that of adults. The lateral surfaces of the body and caudal peduncle were a pale grey which shaded gradually into the off-white of the ventral surface anterior to the anal aperture but contrasted perceptibly dorsally and caudally with the dark plumbeous grey of the dorsal surfaces of the body and flukes. This darker colour may represent an indistinct form of the dorsal cape system described for other delphinids (Perrin, 1972). An incomplete greyish flipper stripe extended from the flipper insertion towards the eye. Though a stripe between the eye and the apex of the melon was not observed, the bridle of other delphinids was represented by distinct dark and pale streaks between the apex of the melon and the blowhole. The ventral surfaces of the flukes and flippers were pale grey and the ridges on the caudal peduncle were off-white.

Individuals in which the falcate portion and posterior part of the dorsal fin are white have been observed at sea frequently. That they are usually large animals suggests that occurrence of this white colouration may be related to age (Saayman *et al.*, 1972; Saayman and Tayler, 1979; personal observations).

The rostrum of the skull is long (61,4–64,0% of CBL), slender and compressed laterally; the premaxillae are arched dorsally along the length of the rostrum. Near the vertex of the cranium the frontal bones are exposed between the posterior margins of the maxillae and the transverse supraoccipital crest for minimum widths of 19–24 mm in five specimens. The pterygoid hamuli are narrow and each has a longitudinal ventral ridge which curves laterally towards the posterior tip. The minimum width between the pterygoids varied from 2–11 mm in five skulls.

The tympanic bullae and periotic bones closely resemble those of *S. teuszii* described and

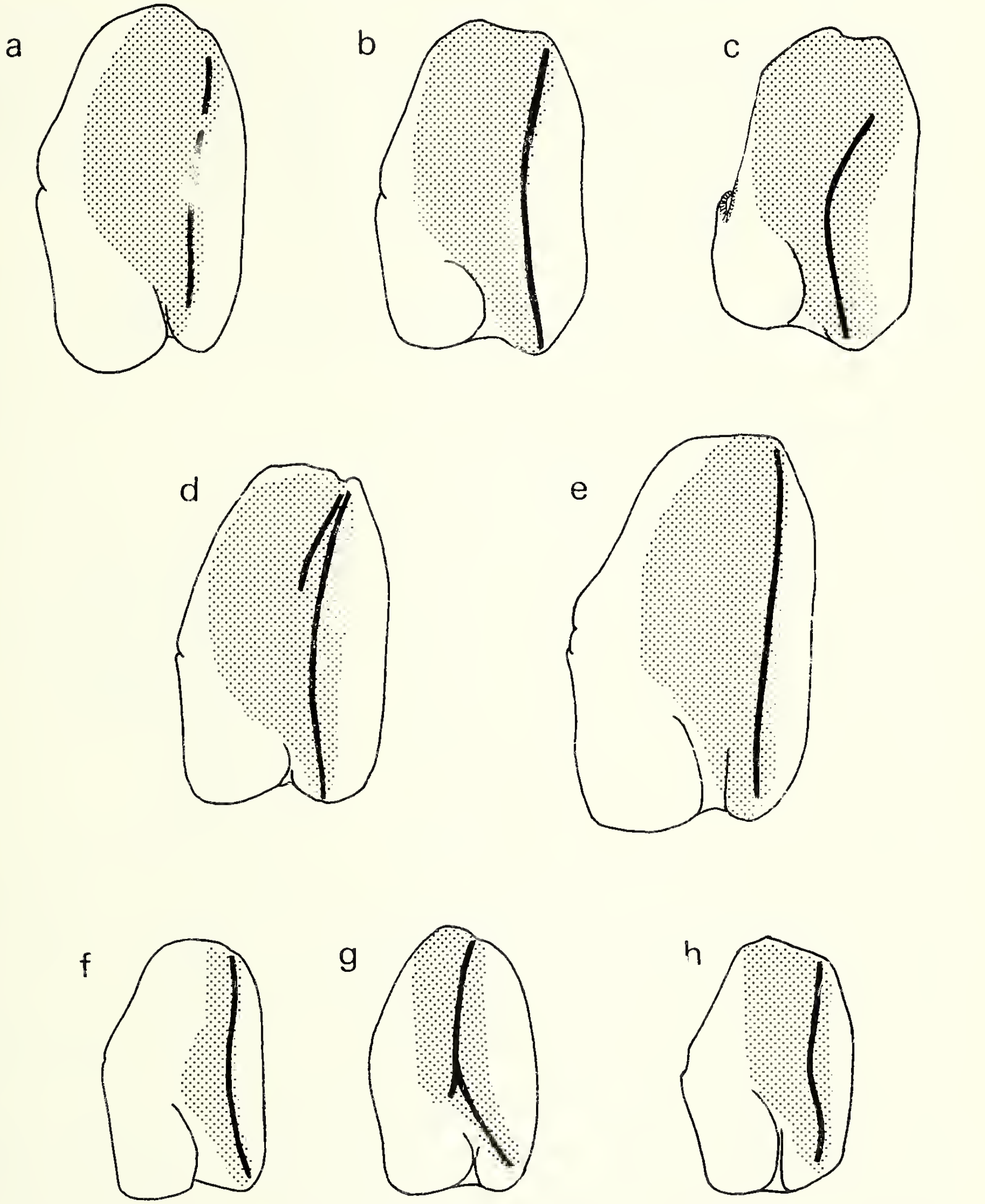


Fig. 29. Ventral aspect of the tympanic bulla of *Mesoplodon*. The black line and dotted area indicate the ventral keel and the rugose area surrounding it:—a. *M. hectori* (PEM 1511/15); b. *M. mirus* (PEM 1514/90); c. *M. layardi* (PEM 4); d. *M. densirostris* (PEM 1518/84); e. *M. grayi* (PEM 5); f. *M. europaeus*; g. *M. ginkgodens*; h. *M. stejnegeri* (f, g and h after Kasuya, 1973).

illustrated by Kasuya (1973). However, the tympanic bullae differ in the form of the interior posterior prominence which tapers to a point in the southern African material.

In adults the teeth are about 7 mm in diameter at the level of the gum. The base of each tooth is usually expanded antero-posteriorly giving it a wedge-shaped appearance in lateral view. In longitudinal section this expansion is seen to consist of dentine in which the growth layers curve outwards at the tooth base and which is covered by a comparatively thin layer of cement. The enamel is not vertically striated. Tooth counts and skull measurements for 12 southern African specimens are provided in Table 112.

The vertebral formulae for seven specimens are listed in Table 113.

### Biology

*Age determination:* Teeth from nine specimens were sectioned for estimating their age. Counts of growth layers and data on the state of maturity are provided in Table 120.

Table 120:

Counts of dentine growth layers in the teeth of nine *Sousa plumbea* from the SE coast of southern Africa.

| Catalogue Number | Total length (mm) | No. of dentine layers | Pulp cavity | Comments |
|---|---|---|---|---|
| PEM 1514/37 | — | 0 | Open | No neonatal line.<br>Prenatal dentine 0,6 mm thick. |
| PEM 1515/76 | 1 080 | 0 | Open | No neonatal line.<br>Prenatal dentine 0,5 mm thick. |
| PEM 1515/77 | 970 | 0 | Open | No neonatal line.<br>Prenatal dentine 0,6 mm thick. |
| PEM 1520/65 | 1 010 | 0 | Open | Neonatal line *c.* 25 μ thick.<br>Prenatal dentine 0,6 mm thick. |
| ZMA 14.597 | 2 540 | 9+ | Closed | Counted to sec. dentine.<br>Physically mature. |
| PEM 1517/95 | 2 790 | 11+ | Closed | Counted to sec. dentine.<br>Physically mature. |
| PEM 1517/97 | 2 710 | 11+ | Closed | Counted to sec. dentine.<br>Physically immature. |
| PEM 1496/63 | — | *c.* 13 | Slightly open | Some sec. dentine lining pulp cavity. |
| PEM 1496/64 | — | 14 | Open | Physically immature. |

The absence of any postnatal dentine deposition in three neonates indicates that they died during or very soon after birth. The width of the neonatal line in the fourth neonate, PEM 1520/65, shows that this animal survived for at least a short period after birth.

The first four or five growth layers in teeth of older animals were the clearest, subsequent layers becoming less distinct. Secondary dentine restricted complete counts to the centre of the tooth in three specimens. The limited data suggest physical maturity is reached after the pulp cavity has closed and some 13 or 14 dentine layers have been deposited.

*Growth and development:* The length at birth is probably about 1 m. The two neonates 0,97 m and 1,08 m in length may have been still born or may have died during birth, as air was absent from the lungs. The presence of vibrissae, birth creases on the body, the folded over dorsal fin and curled flukes indicated very recent birth. The thin layer of postnatal dentine in the teeth of PEM 1520/65, 1,01 m in length, suggests that some increase in length had occurred since birth.

Two physically mature specimens, 2,54 m and 2,79 m in length, provide the only data on the maximum length attained by southern African *S. plumbea*.

Total and partial body masses for two neonates and one adult are given in Table 115.

*Reproduction:* SAM 35100, *c.* 2,44 m in length, was the only female known to be sexually mature. At her death in about March 1963, a foetus *c.* 0,75 m in length was found in the left horn of the uterus (Best, pers. comm.). The length of the foetus suggests that conception had occured in mid-summer. Small calves have been seen in schools sighted in Algoa Bay in February and April. At Plettenberg Bay Saayman and Tayler (1979) observed small calves throughout the year, peak numbers being in summer.

The few data available on the testes of four specimens (Table 116) are all that is known concerning reproduction in male *S. plumbea*. It is uncertain whether the 2,79 m male was sexually mature as the absence of sperm in the epididymis may have been due to decomposition.

*Food and feeding*: Only one stomach examined, that of PEM 1517/95, contained food remains. These consisted entirely of partially digested fish which weighed a total of 5,2 kg and included two *Pomadasys commersonii*, five *P. olivaceum*, one *Macrura kelee*, one *Rhabdosargus thorpei*, one *Liza richardsoni*, three *Liza* species, six *Mugil cephalus*, one *Afroscion thorpei* and an unidentified sciaenid. All of these species occur commonly in the coastal waters of Natal. Most prey items exceeded 300 mm in length; five of the *M. cephalus* were 465–520 mm in length.

Saayman *et al.* (1972) reported *S. plumbea* at Robbeberg, Plettenberg Bay feeding on fish on or close to reefs along rocky coastal areas in preference to areas with a sandy bottom. Personal observations of schools in Algoa Bay indicate similar feeding behaviour. Saayman and Tayler (1979) found that *S. plumbea* showed a tidal rather than a diurnal feeding cycle in periods of feeding which reached their peak about one hour before high tide. Such behaviour is presumably correlated with the very shallow coastal habitat of this species (see under Distribution) and perhaps with a greater availability of prey during the period of the incoming tide.

Elsewhere there are very few records of the prey of *S. plumbea* or other *Sousa* species. A photograph published by Burton (1964) shows *S. plumbea* chasing a mullet in Djibouti harbour. A specimen from Malabar was found to have eaten fish, *Abudefduf caelestinus* and possibly clupeids (Cantor, 1846). A few small crustacea were found in a *S. lentigenosa* stomach (Sterndale, 1887). *S. teuszii* stomachs contained pomadasyids, clupeids and mugilids (Cadenat and Paraiso, 1957; Mitchell, 1975) indicating that this species has a diet similar to that of *S. plumbea*.

The limited data on the food of these species suggest a preference for shoaling fish which frequent shallow water.

*School size*: The estimated size of 49 schools observed by the author in eastern Cape waters ranged from 1 to *c.* 30 individuals with a mean of 6,9 dolphins per school. Most schools (33) contained 7 or fewer animals. Only six schools held more than ten dolphins and two of these schools consisted of two or three smaller groups.

Almost identical mean school size and ranges were obtained by Saayman and Tayler (1973) at Plettenberg Bay (mean 6,6, range 1 to *c.* 25).

### DISTRIBUTION AND MIGRATION

*S. plumbea* is recorded from scattered localities on the coasts bordering the western and northern Indian Ocean, between the Gulf of Siam (Pilleri and Gihr, 1972) and South Africa. In addition to the present material, records from Djibouti (Burton, 1964), Berbera and Zanzibar (Fraser, 1966), Dar-es-Salaam (Howell and Pearson, 1977) and the Zambesi district (Miranda-Ribeiro, 1936) are the only ones of *Sousa* known from the entire east coast of Africa.

In southern African waters *S. plumbea* occurs in the coastal waters of Natal and the eastern Cape. The westernmost limit of distribution is uncertain. Excluding the False Bay skull (Table 117) which is presumed to be that of a vagrant, there are no records west of Gouritz River Mouth where this species may occur regularly. Approximately 150 km further east at

Plettenberg Bay *S. plumbea* appears to be resident throughout the year (Saayman *et al.*, 1972). Similar indications of residency were shown by the seasonal distribution of 52 sightings in Algoa Bay (Table 121). Sightings were made in all months of the year but increased in frequency from January through April. It is suspected however, that this increase may reflect greater observer opportunity and effort during the fine weather and calm seas over this period rather than a real increase in the numbers of *S. plumbea*.

TABLE 121:

Seasonal distribution of 52 sightings of *Sousa plumbea* in Algoa Bay.

| MONTH: | Jan. | Feb. | Mar. | April | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NUMBER OF SIGHTINGS: | 7 | 7 | 8 | 8 | 1 | 3 | 4 | 1 | 4 | 3 | 4 | 2 |

*S. plumbea* appears to be restricted to a very narrow coastal belt, rarely occuring more than about 1 km offshore or in water more than 20 m in depth (personal observations; Saayman *et al.*, 1972). Unlike elsewhere in its distribution *S. plumbea* on the SE coast of southern Africa has not been recorded entering estuaries perhaps because the extreme shallowness of almost all river mouths in this region restricts access to the sea.

## KEY TO ODONTOCETES OF THE SE COAST OF SOUTHERN AFRICA

This key has been modified from Best (1971) to include all odontocetes recorded on the SE coast of southern Africa. In view of the rapid increase in recent years in the number of species recorded as new to this fauna four additional species have been included in the key as it is possible that they may be recorded in this region in the future. These (marked* in key) are the beaked whale *Tasmacetus shepherdi* and the delphinids *Peponocephala electra, Lissodelphis peronii* and the west coast species *Lagenorhynchus obscurus*.

As the main function of the key will be the identification of stranded animals emphasis has been placed on external characters which are still recognizable after considerable decomposition has occurred and on features of the skull. Tooth counts made on whole animals should be interpreted with caution since some teeth may be unerupted (e.g. female and immature beaked whales, the anterior teeth of small dephinids and unweaned animals) or lost in old animals (e.g. *Grampus griseus, Globicephala* and *Kogia* species). These difficulties can be obviated by routine collection of cranial material.

1. Teeth present in lower or both jaws; blowhole single
Sub-order ODONTOCETI .................................................. 2
Baleen present in upper jaw; blowhole double
Sub-order MYSTACOCETI

2. Snout narrow and elongate; one or two pairs of enlarged teeth (usually erupted in adult males only) in lower jaw; no notch in flukes; two grooves on throat forming a V
........................................................ Family Ziphiidae 3
Snout blunt, 7–28 pairs of erupted teeth in lower jaw only; lower jaw narrow and set in depression on ventral surface of head; notch present in flukes.. Family Physeteridae 11
Snout blunt or elongate; 3–60 pairs of teeth in lower or both jaws; gape opens anteriorly; notch present in flukes .............................. Family Delphinidae 13

3 One pair of enlarged teeth; small posterior teeth may be present .................. 4
Two pairs of enlarged teeth at tips of lower jaws; nasals and premaxillae rise above supraoccipital forming a dome-shaped vertex in posterior view ........ *Berardius arnouxi*

TABLE 122:

Co-ordinates of localities referred to in the text.

| | | | | | |
|---|---|---|---|---|---|
| Amanzimtoti | 30° 04′S, 30° 55′E | Hout Bay | 34° 04′S, 18° 21′E | Oro Point | 26° 50′S, 32° 52′E |
| Amsterdamhoek | 33° 52′S, 26° 38′E | Humewood | 33° 58′S, 25° 38′E | Oyster Bay | 34° 10′S, 24° 39′E |
| Aston Bay | 34° 04′S, 24° 55′E | Ifafa | 30° 27′S, 30° 40′E | Paradise Beach | 34° 05′S, 24° 54′E |
| Bakoven | 33° 56′S, 18° 22′E | Igulu Beach | 33° 07′S, 27° 44′E | Plettenberg Bay | 34° 03′S, 23° 24′E |
| Beachview | 34° 00′S, 25° 49′E | Jeffreys Bay | 34° 03′S, 24° 55′E | Port Alfred | 33° 36′S, 26° 55′E |
| Bird Island | 33° 51′S, 26° 17′E | Kaiser's Beach | 33° 12′S, 27° 36′E | Richard's Bay | 28° 50′S, 32° 03′E |
| Blythesdale Beach | 29° 39′S, 31° 36′E | Kabeljous River Mouth | 34° 00′S, 24° 57′E | Riet Point | 33° 34′S, 27° 00′E |
| Bonza Bay | 32° 58′S, 27° 58′E | Kariega River Mouth | 33° 41′S, 26° 41′E | Robbeberg | 34° 07′S, 23° 23′E |
| Buffalo River Mouth | 33° 02′S, 27° 55′E | Kasuga River Mouth | 33° 40′S, 26° 44′E | Salt Rock | 29° 30′S, 31° 16′E |
| Bushmans River Mouth | 33° 42′S, 26° 41′E | Kidd's Beach | 33° 09′S, 27° 42′E | Sardinia Bay | 34° 02′S, 25° 31′E |
| Cannon Rocks | 33° 45′S, 26° 33′E | King's Beach | 33° 59′S, 25° 39′E | Schoenmakerskop | 34° 02′S, 25° 31′E |
| Cape Agulhas | 34° 50′S, 20° 00′E | Kini Bay | 34° 01′S, 25° 26′E | Scottburgh | 30° 17′S, 30° 46′E |
| Cape Receife | 34° 01′S, 25° 42′ E | Klaasie's River Mouth | 34° 06′S, 24° 20′E | Seaview | 34° 01′S, 25° 27′E |
| Cape St. Francis | 34° 12′S, 24° 52′E | Klipdrift | 34° 10′S, 24° 34′E | Sedgefield | 34° 02′S, 22° 48′E |
| Cefane | 32° 48′S, 28° 08′E | Knoetzie | 34° 04′S, 23° 08′E | Sordwana Bay | 27° 34′S, 32° 41′E |
| Coega River Mouth | 33° 48′S, 25° 41′E | Knysna | 34° 03′S, 23° 03′E | Springmount | 34° 45′S, 26° 12′E |
| Cove Rock | 33° 05′S, 27° 49′E | Kromme River Mouth | 34° 08′S, 24° 51′E | Stag Island | 33° 50′S, 26° 17′E |
| Danger Point | 34° 38′S, 19° 18′E | Kwaaihoek | 33° 43′S, 26° 39′E | St. Georges Strand | 33° 50′S, 25° 40′E |
| Durban | 29° 50′S, 31° 00′E | La Lucia | 29° 42′S, 31° 06′E | St. Michael's-on-Sea | 30° 51′S, 30° 23′E |
| East London | 32° 58′S, 27° 58′E | Laurie's Bay | 34° 02′S, 25° 23′E | Storms River Mouth | 34° 02′S, 23° 54′E |
| Eerste River Mouth | 34° 05′S, 24° 14′E | Maitland River Mouth | 33° 58′S, 25° 17′E | Sundays River Mouth | 33° 42′S, 25° 51′E |
| Elands River Mouth | 34° 03′S, 24° 05′E | Mazeppa Bay | 32° 28′S, 28° 39′E | Swartkops Beach | 33° 52′S, 25° 38′E |
| Fish River Mouth | 33° 30′S, 27° 08′E | Morgan's Bay | 32° 43′S, 28° 20′E | Thysbaai | 34° 11′S, 24° 43′E |
| Fish River Point | 33° 31′S, 27° 07′E | Mossel Bay | 34° 10′S, 22° 08′E | Umhloti | 29° 38′S, 31° 08′E |
| Gamtoos River Mouth | 34° 00′S, 25° 17′E | Mpelane | 28° 24′S, 32° 26′E | Umhlanga Rocks | 29° 45′S, 31° 04′E |
| Gibson Bay | 34° 10′S, 24° 32′E | Mtunzini | 28° 59′S, 31° 43′E | Van Staden's River Mouth | 33° 58′S, 25° 13′E |
| Gordons Bay | 34° 10′S, 18° 52′E | Muizenberg | 34° 07′S, 18° 28′E | Walker Bay | 34° 30′S, 19° 20′E |
| Gouritz River Mouth | 34° 22′S, 21° 53′E | Nature's Valley | 33° 59′S, 23° 34′E | Wilderness | 34° 00′S, 22° 34′E |
| Haga Haga | 32° 45′S, 28° 15′E | Noordhoek | 34° 02′S, 25° 39′E | Willows | 34° 03′S, 25° 35′E |
| Hamburg | 33° 17′S, 27° 29′E | Orient Beach | 32° 58′S, 27° 58′E | Woody Cape | 33° 46′S, 26° 19′E |

4 Enlarged teeth circular in cross-section, set at tips of lower jaws .......... 5
Enlarged teeth compressed transversely .......... 6

5 Tip of snout to blowhole 14–22% body length; apex of melon well-defined; dorsal apices of maxillary prominences rise above level of mesethmoid in profile; in dorsal view nasals form less than half area of vertex of skull .......... *Hyperoodon planifrons*
Tip of snout to blowhole 9–13% body length; apex of melon poorly defined; mesethmoid rises above level of apices of maxillary prominences in profile; in dorsal view nasals form more than half area of vertex of skull .......... *Ziphius cavirostris*

6 Enlarged teeth set anteriorly; 17–28 small erupted teeth in both jaws; in dorsal view nasals sub-symmetrical and project anteriorly in midline .......... *Tasmacetus shepherdi**
Enlarged teeth set variously in lower jaws; small teeth in upper jaw only, if present; in dorsal view nasals assymmetrical with lateral parts projecting anteriorly .......... genus *Mesoplodon* 7

7 Teeth set at or close to tips of lower jaws .......... 8
Teeth set at or posterior to posterior end of symphysis .......... 9

8 Teeth set at tips of lower jaws; premaxillary crests broader than premaxillary width at anterior border of nares .......... *M. mirus*
Teeth set 10–25 mm from tips of lower jaws; breadth of premaxillary crests equal to or less than premaxillary width at anterior border of nares .......... *M. hectori*

9 Line of gape almost straight; dorsal margin of mandible approximately straight; teeth not directed antero-dorsally .......... 10
Line of gape rises abruptly at about midlength; dorsal margin of mandible strongly elevated at midlength; teeth directed antero-dorsally .......... *M. densirostris*

10 Teeth directed postero-dorsally; in dorsal view prominential notches present where maxillae widen at base of rostrum .......... *M. layardi*
Teeth directed dorsally; no prominential notches in dorsal view; 15–22 rudimentary teeth in upper jaw .......... *M. grayi*

11 Less than 3,5 m in length; 7–16 pairs of teeth in lower jaws; blowhole 7–13% body length from tip of snout .......... genus *Kogia* 12
More than 3,5 m in length; 18–28 pairs of teeth in lower jaws; blowhole at tip of snout .......... *Physeter macrocephalus*

12 Blowhole 7–10% body length from snout; dorsal fin height more than 5% body length; 7–12 pairs of teeth in each lower jaw; dorsal sagittal septum width less than 20 mm .......... *K. simus*
Blowhole 10–13% body length from snout; dorsal fin height less than 5% body length; 12–16 pairs of teeth in each lower jaw; dorsal sagittal septum width more than 20 mm in adults .......... *K. breviceps*

13 2–7 pairs of teeth present in lower jaw only; shallow vertical depression along midline of melon; no beak .......... *Grampus griseus*
7 pairs of teeth or more in upper and lower jaws; beak present or absent .......... 14

14 13 pairs of teeth or less in upper and lower jaws .......... 15
19 pairs of teeth or more in upper and lower jaws .......... 19

15 Teeth flattened antero-posteriorly; short beak present .......... *Orcinus orca*
Teeth rounded in cross-section .......... 16

16 7–12 pairs of teeth restricted to anterior half of rostrum, short beak present .......... genus *Globicephala* 17
7–13 pairs of teeth set over two thirds of rostrum or more; beak absent .......... 18

17 9–12 pairs of teeth in both jaws; flipper length 18–27% body length; anteriorly premaxillae do not cover maxillae completely .......... *G. melaena*
7–10 pairs of teeth in both jaws; flipper length 14–19% body length; anteriorly premaxillae expanded to cover maxillae almost completely .......... *G. macrorhynchus*

18 Teeth set in anterior two thirds of rostrum; premaxillae expanded proximally .............. *Feresa attenuata*
Teeth set over entire length of rostrum; premaxillae not expanded proximally .............. *Pseudorca crassidens*

19 37–60 pairs of teeth in both jaws .............. 20
19–38 pairs of teeth in both jaws .............. 25

20 Palate with shallow or deep longitudinal grooves .............. 21
Palate not grooved .............. 23

21 Beak less than 2% body length; rostrum broad at base .............. *Lagenodelphis hosei*
Beak more than 6% body length; rostrum narrow at base .............. 22

22 Dark flipper stripe to anterior half of lower jaw; palatal grooves deep .. *Delphinus delphis*
Dark flipper stripe to eye; palatal grooves shallow .............. *Stenella longirostris*

23 No dorsal fin; rostral portion of premaxillae flat in profile .............. *Lissodelphis peronii**
Dorsal fin present; rostral portion of premaxillae convex in profile .............. 24

24 Dark stripe between eye and anus; dark flipper stripe to eye .............. *Stenella coeruleoalba*
No dark body stripe; dark flipper stripe to angle of gape .............. *Stenella attenuata*

25 Well-defined beak; rostral portion of premaxillae convex in profile .............. 26
Beak absent or indistinct; rostral portion of premaxillae flat in profile .............. 28

26 20–29 pairs of teeth in both jaws; dorsal fin not set on longitudinal ridge; mandibular symphysis less than 25% mandible length .............. genus *Tursiops* 29
30–38 pairs of teeth in both jaws; dorsal fin set on prominent ridge; mandibular symphysis more than 25% mandible length .............. *Sousa plumbea*

27 20–24 pairs of teeth in both jaws; beak length less than 5% body length; pterygoid notch broad with obtuse apex .............. *Tursiops truncatus*
23–29 pairs of teeth in both jaws; beak length more than 4,5% body length; pterygoid notch narrow with acute apex .............. *Tursiops aduncus*

28 Beak absent; bulbous melon; 19–25 pairs of teeth in both jaws ... *Peponocephala electra**
Beak indistinct, but demarcated by lateral grooves; melon not bulbous; 28–34 teeth in both jaws .............. *Lagenorhynchus obscurus**

## DISCUSSION

### Taxonomy and Biology

The taxonomic status of 12 species in the fauna of the SE coast of southern Africa can be considered well-established. These include the beaked whales *Mesoplodon layardi, M. densirostris, Ziphius cavirostris* and *Hyperoodon planifrons,* both species of *Kogia,* and the delphinids *Orcinus orca, Pseudorca crassidens, Globicephala melaena, Grampus griseus, Delphinus delphis* and *Stenella coeruleoalba.* The present study has confirmed their identity in southern African waters and provided some data on specific variation. The range of variation shown by specimens of *Delphinus* in this region indicates that *D. capensis* Gray should be considered a junior synonym of *D. delphis. Grampus richardsonii* was confirmed to be a synonym of *G. griseus.* It is important that collection of taxonomic material should be continued for identifying different populations in the future.

The specific identifications of six species are considered adequate at present but would benefit from future revision based on more material either because present samples are very small or because the identity of specimens from other regions requires confirmation. These species are *Mesoplodon hectori, M. grayi, M. mirus, Feresa attenuata, Globicephala macrorhynchus* and *Lagenodelphis hosei.* In particular, the possible sub-specific status of the populations of *M. mirus* requires re-evaluation.

The specific status of each of the remaining six species for various reasons warrants re-examination. *Berardius arnouxi* is clearly very similar to its northern counterpart *B. bairdi* and further material may show that they represent a single species. The relationship between *Tursiops aduncus* and *T. truncatus* off southern Africa may be clarified when populations elsewhere have been examined in more detail. More material from all populations of *Sousa* is required for a re-evaluation of this entire genus. The intermediate features shown by *Sousa* and *Stenella attenuata* from southern Africa compared with those of specimens from the Atlantic and the Indo-Pacific indicate the need for more material from this region prior to a further evaluation of the taxonomic status of the Atlantic forms. Adult specimens of *S. longirostris* are also needed to confirm the identity of this species in southern African waters and to establish its relationship with *S. longirostris* and *S. clymene* in the Atlantic.

Studies on life history parameters have progressed more slowly. Reproductive, ageing and growth studies are hindered by low overall sample sizes and the bias towards young and old animals in the stranding record (Fraser, 1966; Ross, 1977). However, the life history framework for each of the five most frequently examined species *(Tursiops aduncus, Delphinus delphis, Stenella coeruleoalba* and both *Kogia* species) (Ross, 1977, 1979; present study) is gradually forming as material accumulates. It is significant that much of the most useful data for *T. aduncus* and *D. delphis* stem from dolphins caught in the Natal shark nets. In addition, the few data collected for some beaked whales, particularly *Mesoplodon mirus* and *M. densirostris,* have considerably expanded previous knowledge of their biology.

The diets of the same five frequently recorded species are the best-known. Some useful data were collected on prey items of the poorly-known species *Ziphius cavirostris, Sousa plumbea* and *Pseudorca crassidens.* The reference collections of otoliths and cephalopod beaks initiated for use in this project have been an essential adjunct to these feeding studies and their further expansion is presently a priority.

Predictably distribution and seasonality are best established in the three inshore delphinids *Tursiops aduncus, Delphinus delphis* and *Sousa plumbea* for which most sighting data including quantitative observations are available. These aspects are partly known for another ten species. However, further data are required and information on the remaining 11 species is presently inadequate.

Though progress on biological aspects has been limited it is important to bear in mind that only nine of the 24 species in this fauna are exploited directly or indirectly anywhere in man's fishing activities so that stranded animals or specimens collected by research vessels provide the only source of biological data for more than 60% of the fauna. Further, in a comparatively short period, the monitoring of southern African strandings has provided nearly one third of the world's recorded material for three species of *Mesoplodon,* both species of *Kogia* and *Lagenodelphis hosei,* albeit with small sample sizes for some species, suggesting that this region has the potential for a most effective contribution to the biology of these cetaceans. These studies are particularly relevant in view of the small number of marine mammalogists working in the southern hemisphere and of the wide spacing of land masses. As a result southern Africa is a major sampling point for the cetacean faunas of much of the South Atlantic and South Indian Oceans. In this context southern African biologists have a task approaching an obligation to investigate all stranded material as thoroughly as possible.

## The Fauna—Zoogeographical Components

The number of species, 24, forming the small cetacean fauna in the study region is comparatively high in relation to the numbers of species recorded, 28 and 27, as forming the cetacean faunas of the North Atlantic and North Pacific Oceans south of the Arctic region (Cadenat, 1958; Leatherwood *et al.*, 1972, 1976; Nishiwaki, 1967; Perrin *et al.*, 1977). The diversity in southern African waters results from the transitionary nature, in a zoogeographical sense, of this fauna, resulting from the variable oceanographic conditions around the southern tip of

Africa. In distributional terms, the small cetacean fauna can be divided into four components.

1. A tropical/sub-tropical component containing species clearly associated with the Agulhas Current *(Stenella coeruleoalba, S. attenuata, Lagenodelphis hosei)* and having a tropical distribution elsewhere *(Globicephala macrorhynchus, Mesoplodon densirostris* and probably *Stenella longirostris).* The westward distribution beyond the direct influence of the Agulhas Current (i.e. west of about 27°E) of the coastal species *Sousa plumbea* and *Tursiops aduncus* is probably possible due to the presence of large sheltered bays with warmer waters as far west as Mossel Bay (Table 1). West of this point and particularly west of Cape Agulhas coastal temperatures become increasingly temperate.

2. A temperate/subantarctic component containing species associated with the cool water which intrudes eastwards inshore of the Agulhas Current *(Mesoplodon layardi, Globicephala melaena, Delphinus delphis).* Only one of these, *D. delphis*, is known to occur frequently in eastern Cape waters. However, it appears to make an annual winter migration to Natal coinciding with the Natal 'sardine run'.

*Mesoplodon hectori* has been included in this group with some hesitation because this species has a circumpolar distribution south of 45°S (based on five records) and the single South African record could justifiably be classified as a vagrant rather than a regular member of the fauna. A similar status may be assigned to *M. grayi* for which there are only three or four South African records. In contrast, though stranding records of the subantarctic species *Berardius arnouxi* and *Hyperoodon planifrons* are equally rare, sight records off the SE coast of large beaked whales assignable to one of these species (most probably the latter) are frequent indicating that at least one of these species occurs regularly in southern African waters.

3. A cosmopolitan component represented by species which occur in both warm and cool water off southern Africa. This category includes truly cosmopolitan species such as *Orcinus orca* as well as species widespread in temperate and tropical regions *(Kogia breviceps, Pseudorca crassidens, Grampus griseus). Feresa attenuata* and *Ziphius cavirostris* are included in this category since they are recorded on the west coast of southern Africa (Best, 1970; Ross and Tietz, 1972) but appear to have greater affinities with the tropical/sub-tropical fauna (Moore, 1963a; Caldwell and Caldwell, 1971b). Conversely southern African *Tursiops truncatus* appears to have most affinities with the temperate fauna of the west coast but it also occurs offshore in the SW Indian Ocean (Ross, 1977).

4. A 'mixed water' component containing two species *Kogia simus, Mesoplodon mirus*, which apparently have restricted distributions in the region of mixing cool and warm waters. Together with the single endemic west coast species, Heaviside's dolphin, *Cephalorhynchus heavisidii*, these are the only species with apparently isolated populations contained wholly within the southern African region.

The possible association between the distribution of *K. simus* and the Agulhas Bank has been suggested earlier. A similar association for *M. mirus* seems unlikely since beaked whales are generally considered oceanic species. Moore (1963b, 1966) provided evidence indicating that the distribution of *M. carlhubbsi* and *M. stejnegeri* in the North Pacific, and *M. bidens, M. mirus* and *M. europaeus* in the North Atlantic were essentially allopatric, rather than sympatric. A similar situation is apparent off southern Africa, where *M. mirus* seems to be confined to a comparatively small region off the southern and eastern Cape coasts in the area of overlap in the distributions of the widespread warm water species *M. densirostris* and the circumpolar cold water species *M. layardi.* If due allowance is made for distributional overlaps resulting from vagrant animals, these distributions can be interpreted as allopatric, perhaps as a result of competition.

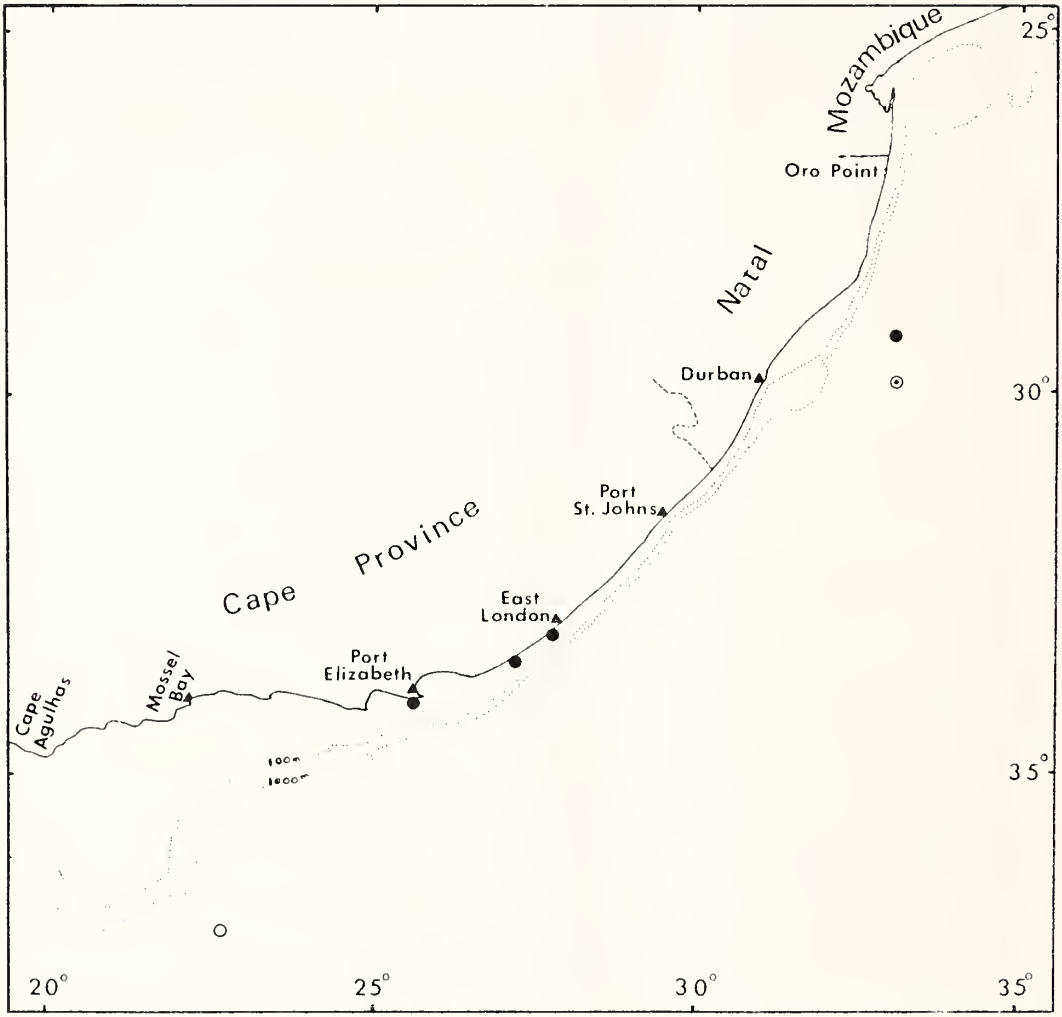


Fig. 30. Distribution of *Ziphius cavirostris*, on the SE coast of southern Africa, as shown by carcases (●), one specimen taken during whaling (⊙) and one sight record (○).

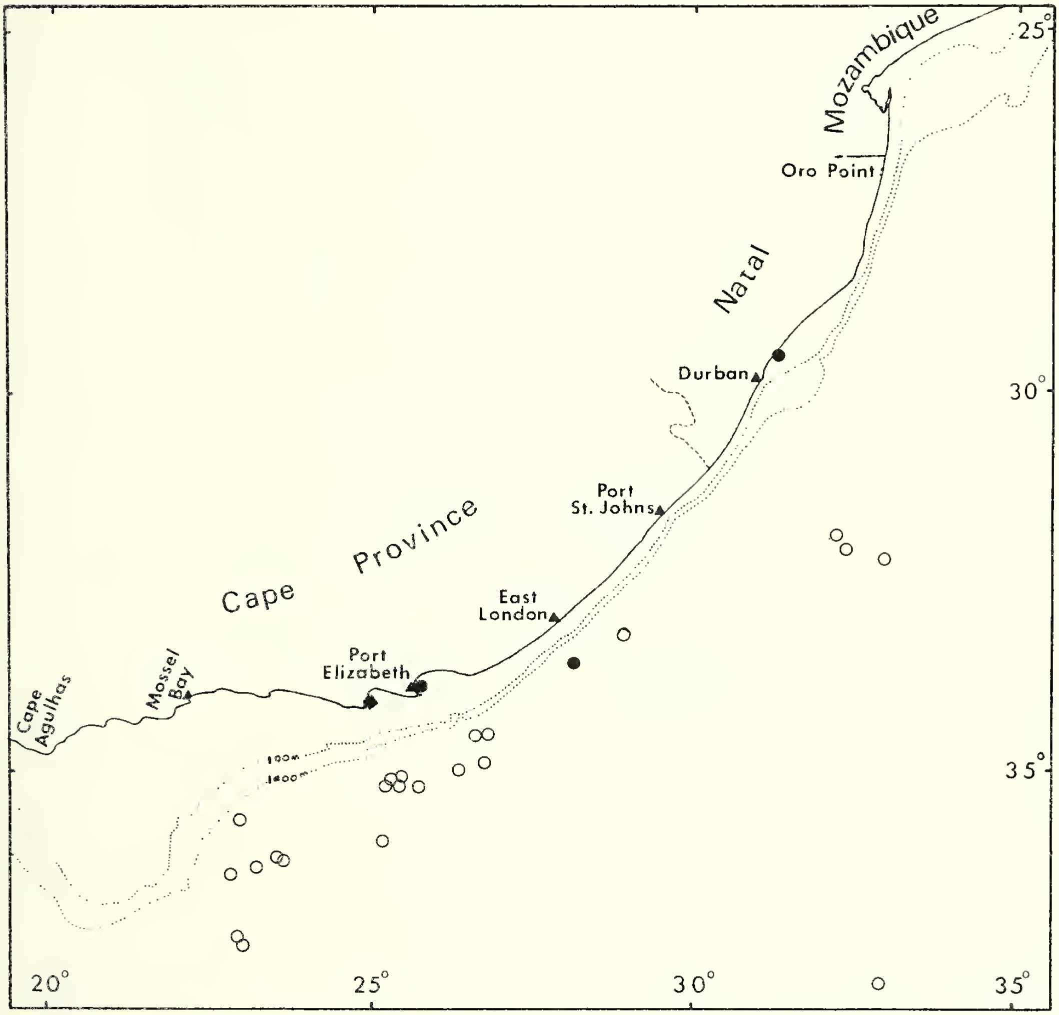


Fig. 31. Distribution of specimens of *Hyperoodon planifrons*, (●), *Berardius arnouxi* (◆), and sight records attributed to *H. planifrons* (○) on the SE coast of southern Africa.

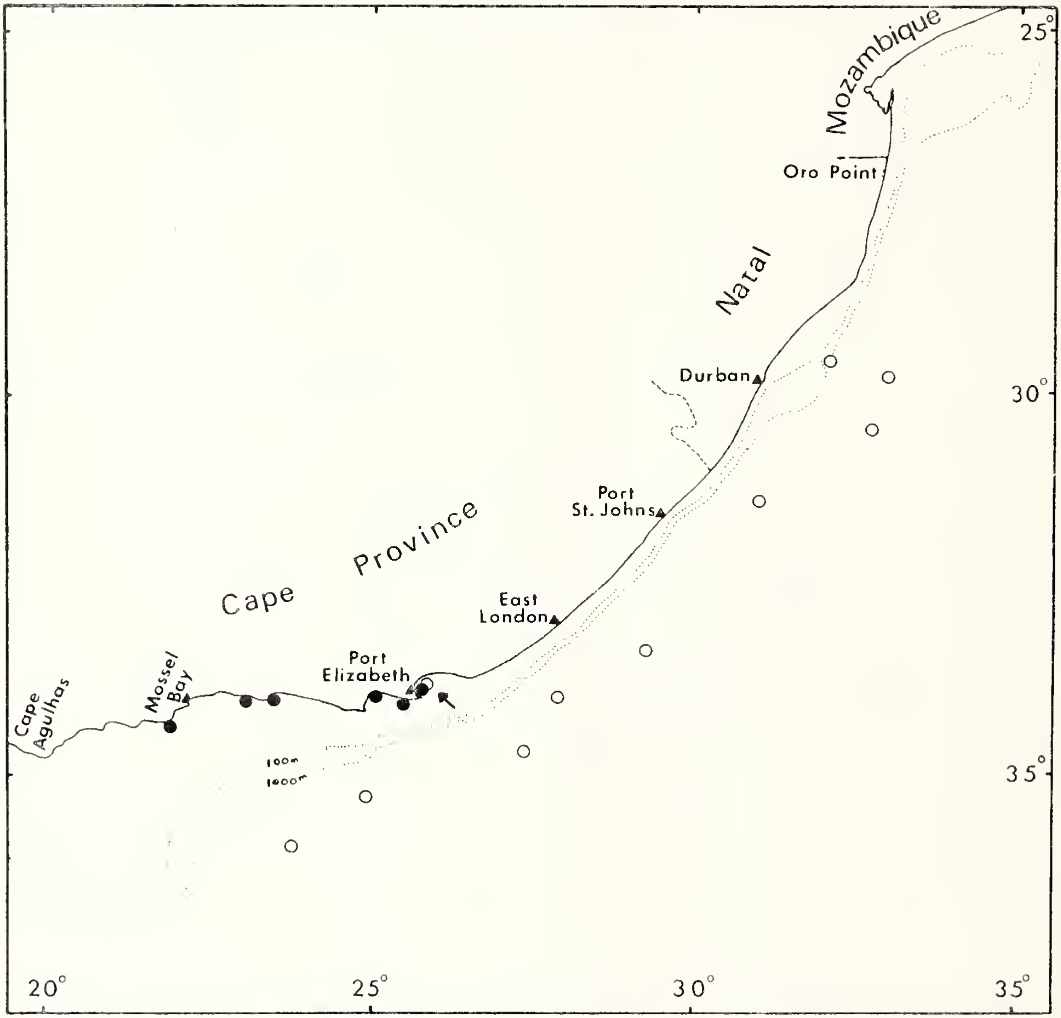


Fig. 32. Distribution of strandings (●) and sight records (○) of *Orcinus orca* on the SE coast of southern Africa. The arrow indicates the positions of one additional sight record and two strandings.

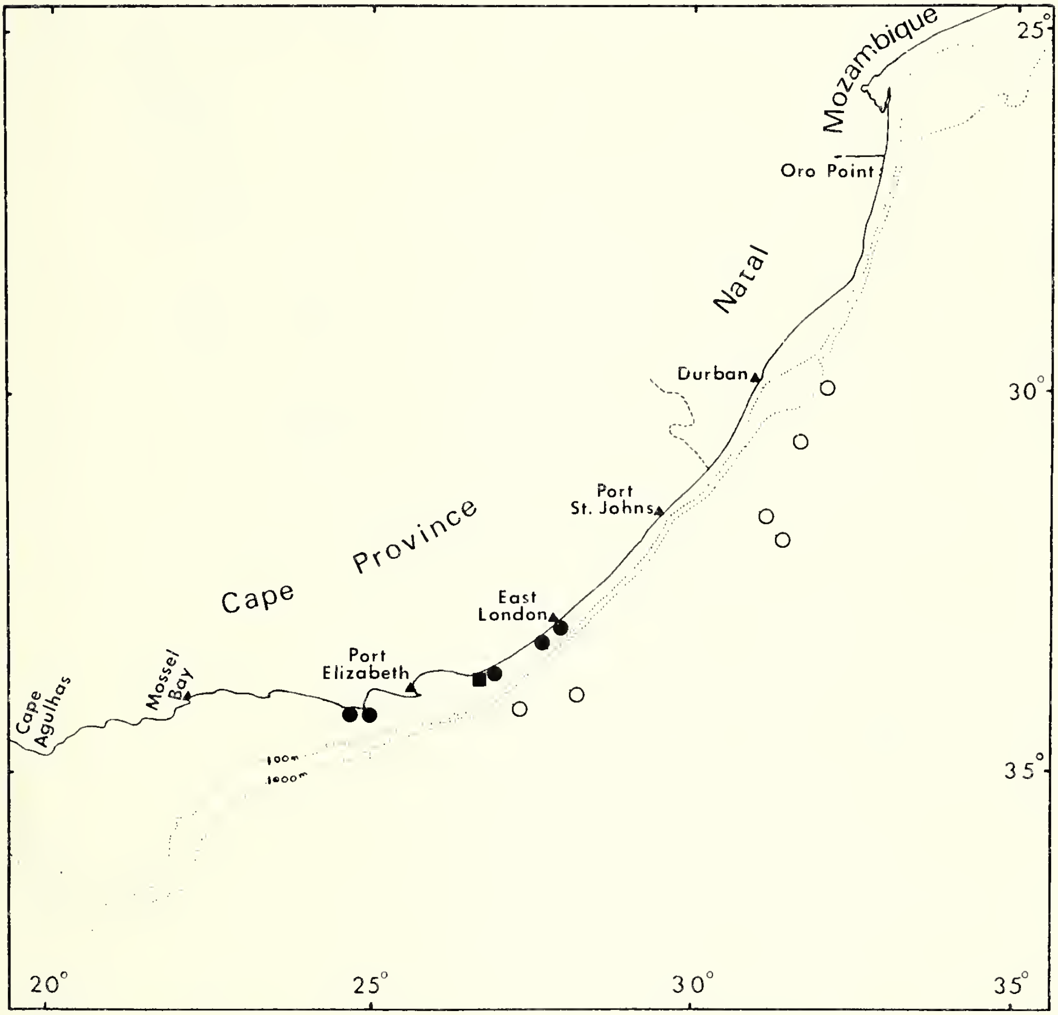


Fig. 33. Distribution of single (●) or two (■) strandings and sight records (○) of *Pseudorca crassidens* on the SE coast of southern Africa.

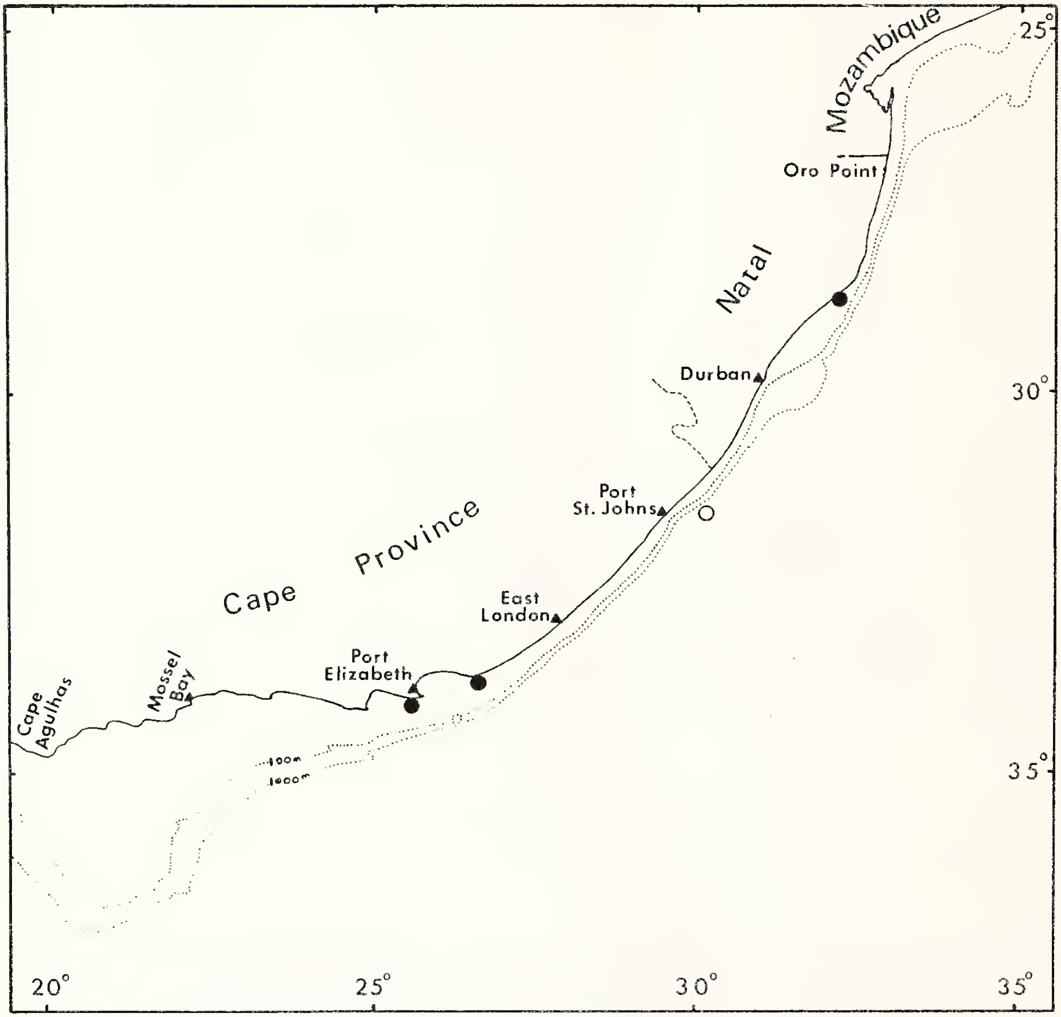


Fig. 34. Distribution of strandings (●) and one sight record (○) of *Feresa attenuata* on the SE coast of southern Africa.

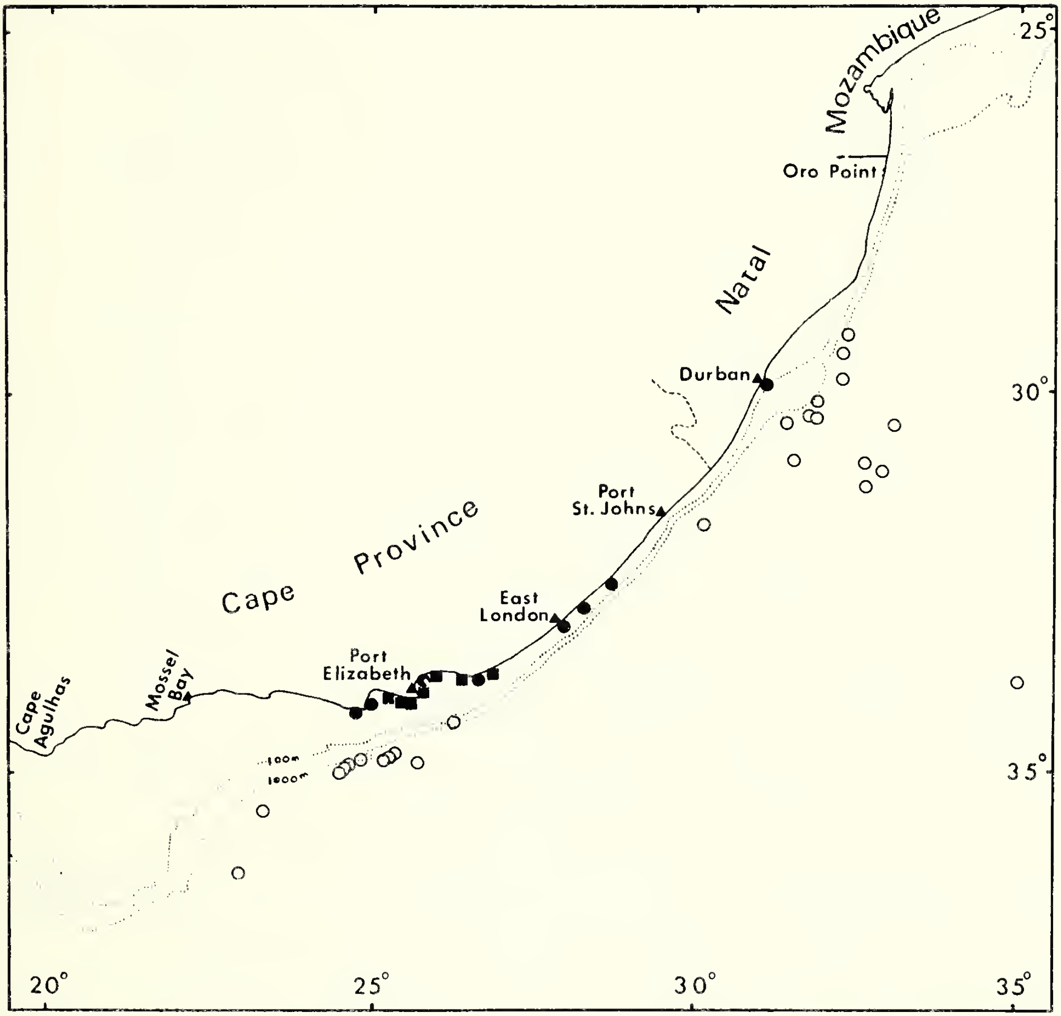


Fig. 35. Distribution of *Grampus griseus* on the SE coast of southern Africa, as shown by one (●) or two strandings (■), and sight records (○).

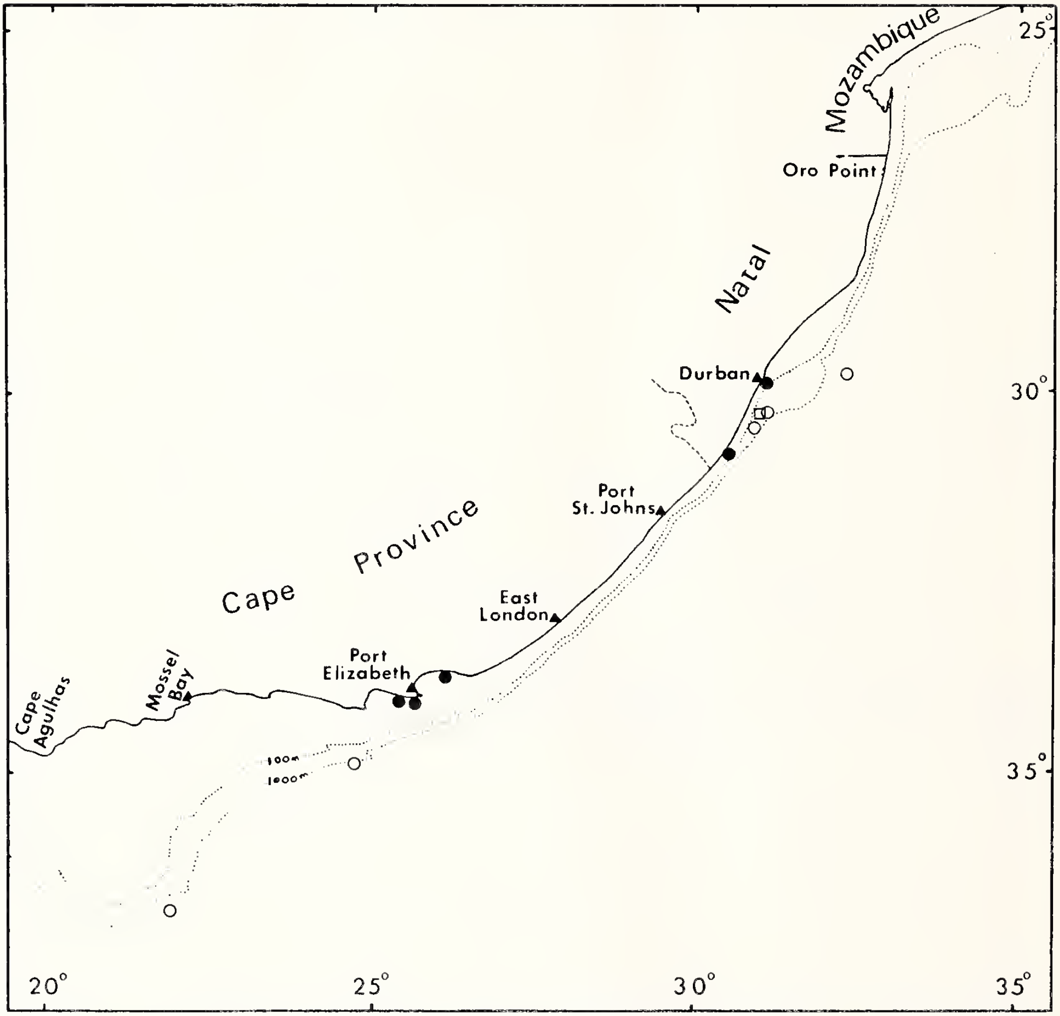


Fig. 36. Distribution of *Tursiops truncatus* on the SE coast of southern Africa, as shown by strandings (●), sight records (□), and sightings possibly attributable to this species (○).

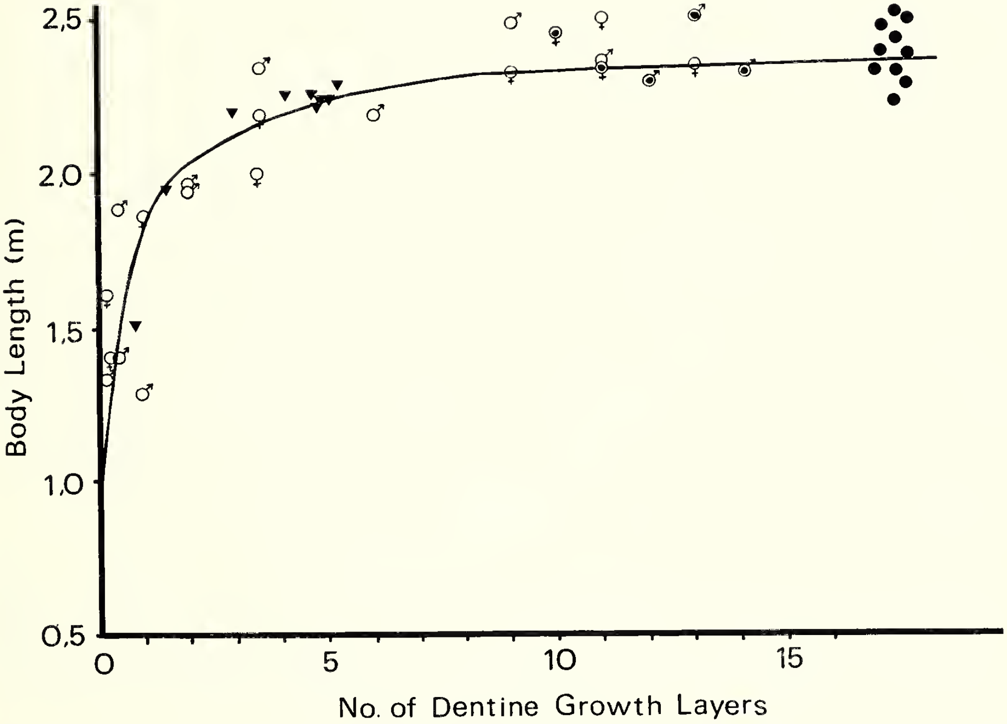


Fig. 37. Growth curve for male and female *Tursiops aduncus* fitted by eye. (○). Teeth with open pulp cavities, all growth layers counted; (⦿) teeth with open pulp cavities, layers counted to secondary dentine; (●) physically mature animals, teeth with occluded pulp cavities, layers counted to secondary dentine. The curve passes through the mean length at birth and mean length of 10 physically mature specimens. Superimposed data for a known-age captive male (▼) fitted the curve best when a deposition rate of one layer/year was assumed.

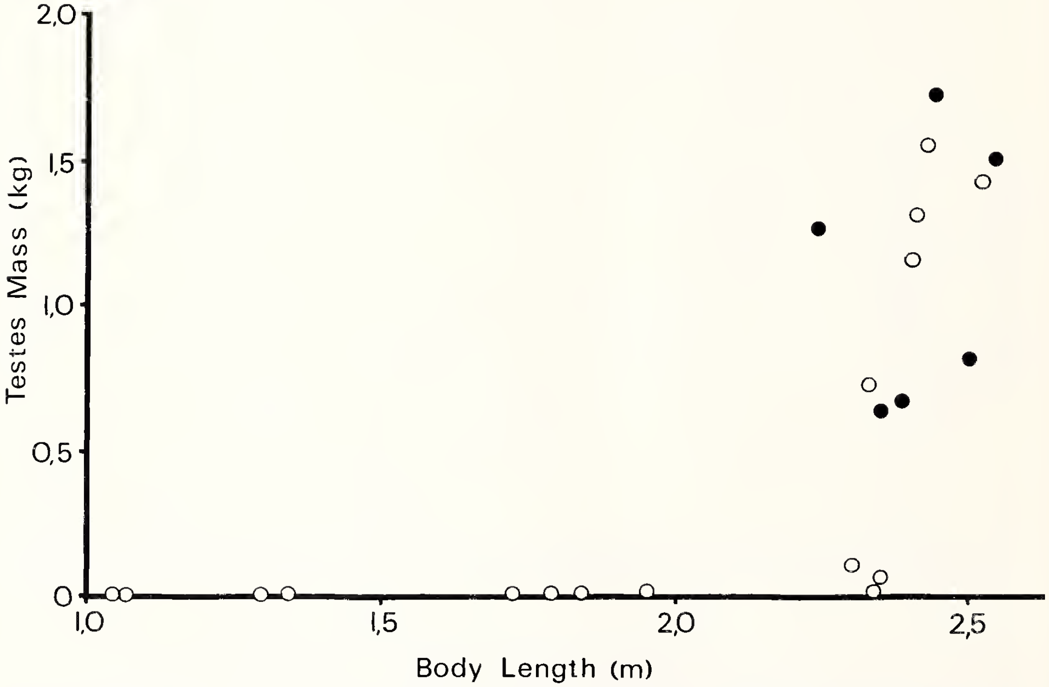


Fig. 38. Relationship between body length and testes mass in *Tursiops aduncus*. Sexually mature males are marked ●.

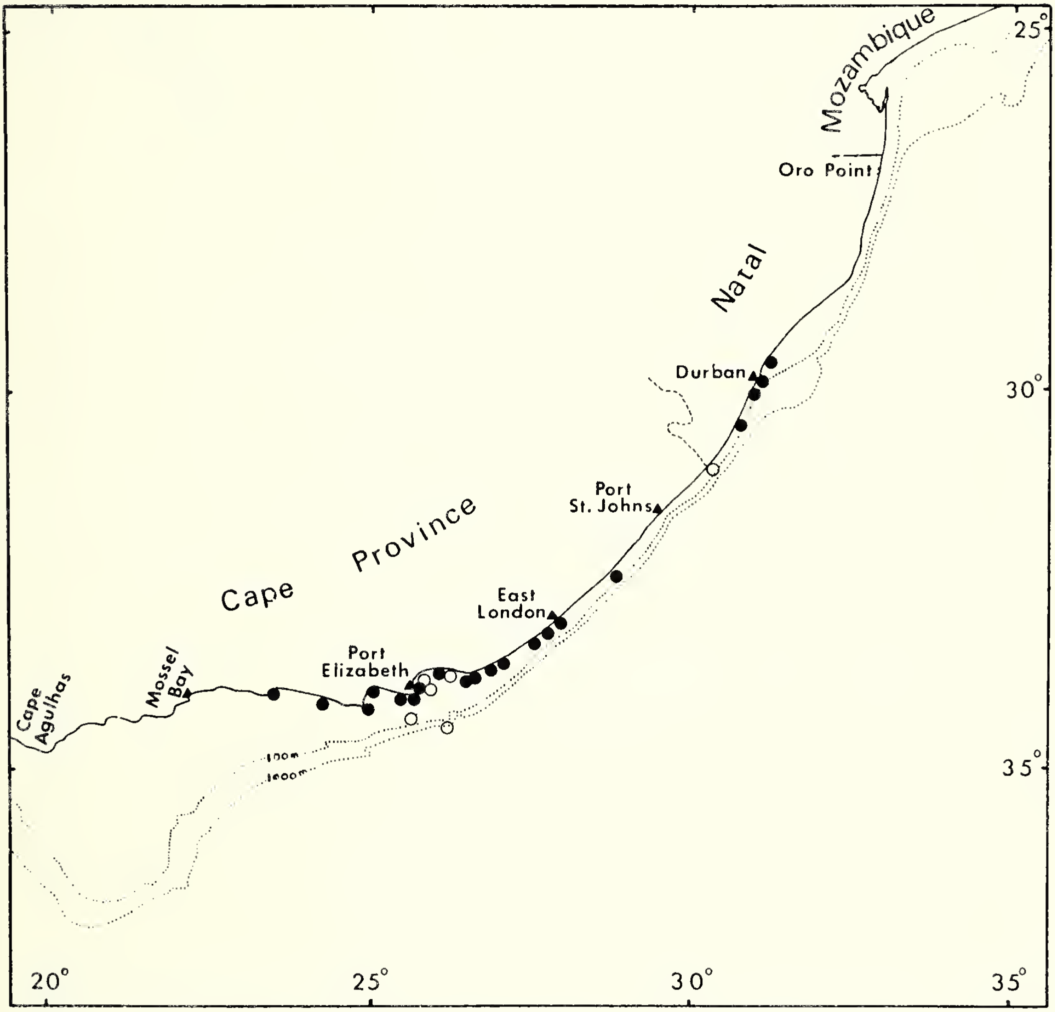


Fig. 39. Distribution of one or more strandings (●) and sight records (○) of *Delphinus delphis* on the SE coast of southern Africa.

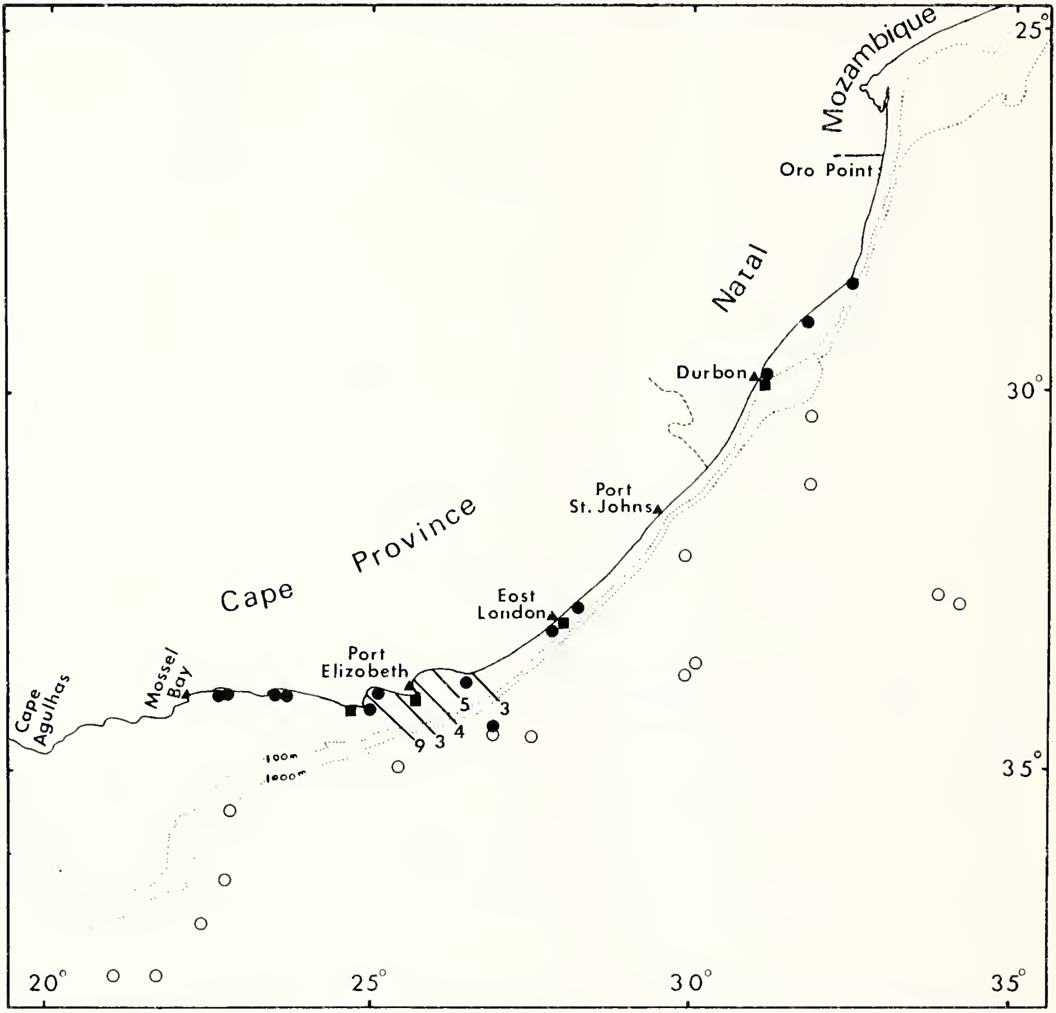


Fig. 40. Distribution of one (●), two (■) or more (numbered) specimens and sight records (○) of *Stenella coeruleoalba* on the SE coast of southern Africa.

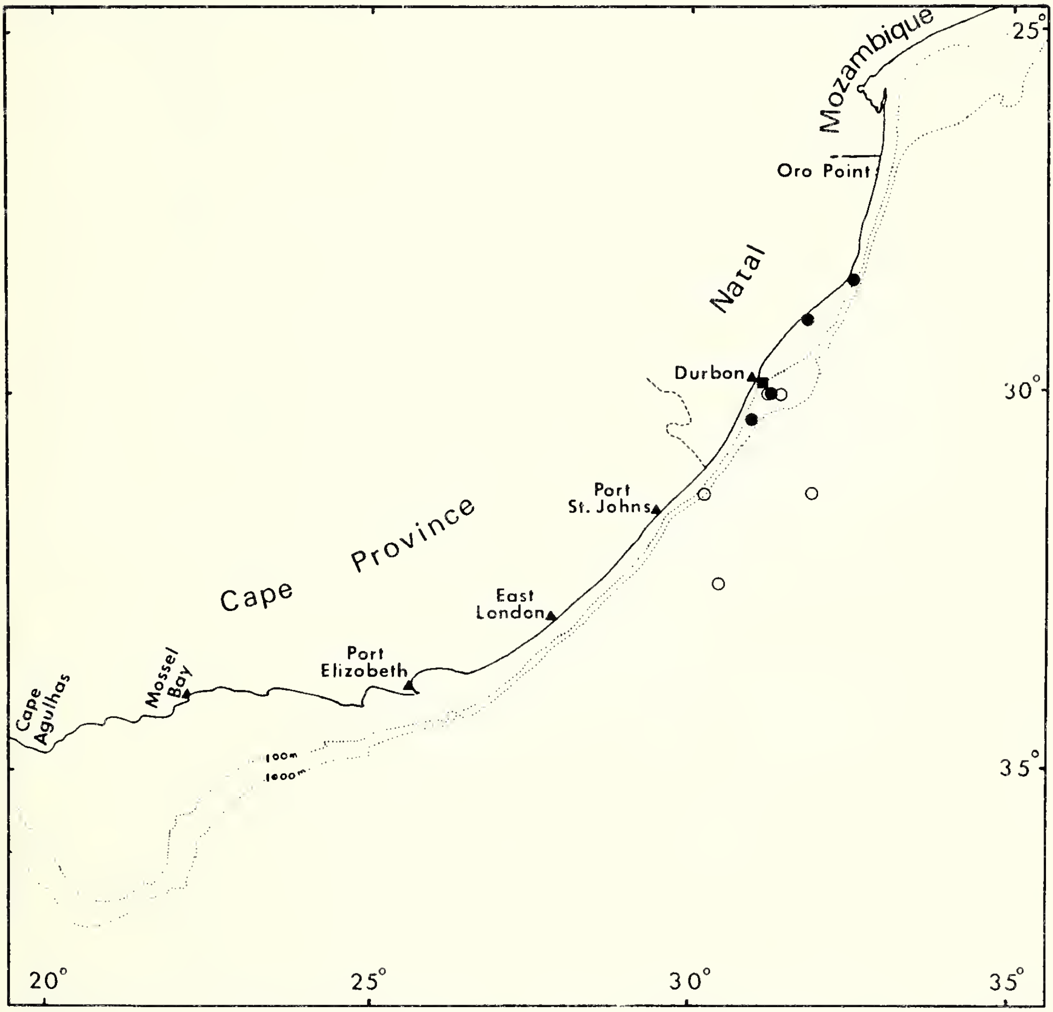


Fig. 41. Distribution of one (●) or two (■) specimens and sight records (○) of *Stenella attenuata* on the SE coast of southern Africa.

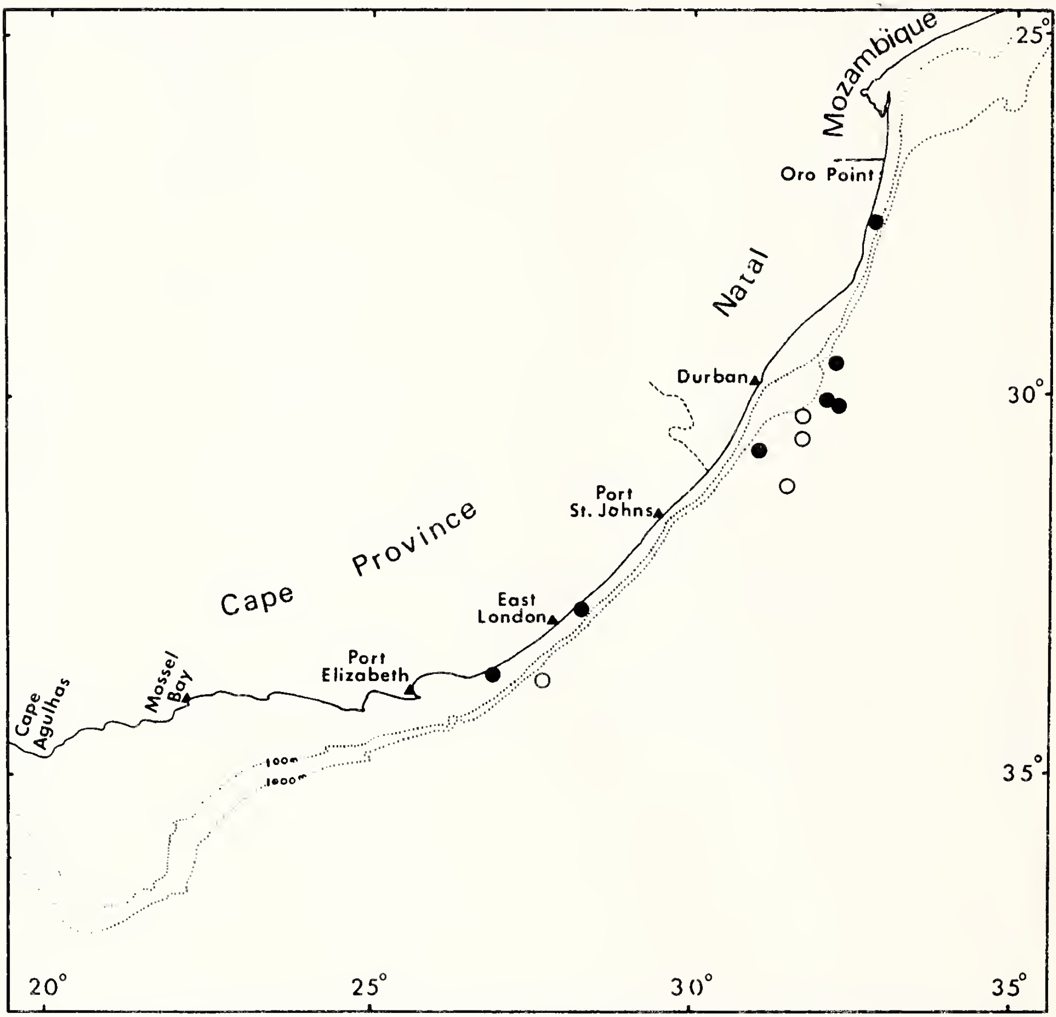


Fig. 42. Distribution of specimens (●) and sight records (○) of *Lagenodelphis hosei* on the SE coast of southern Africa.

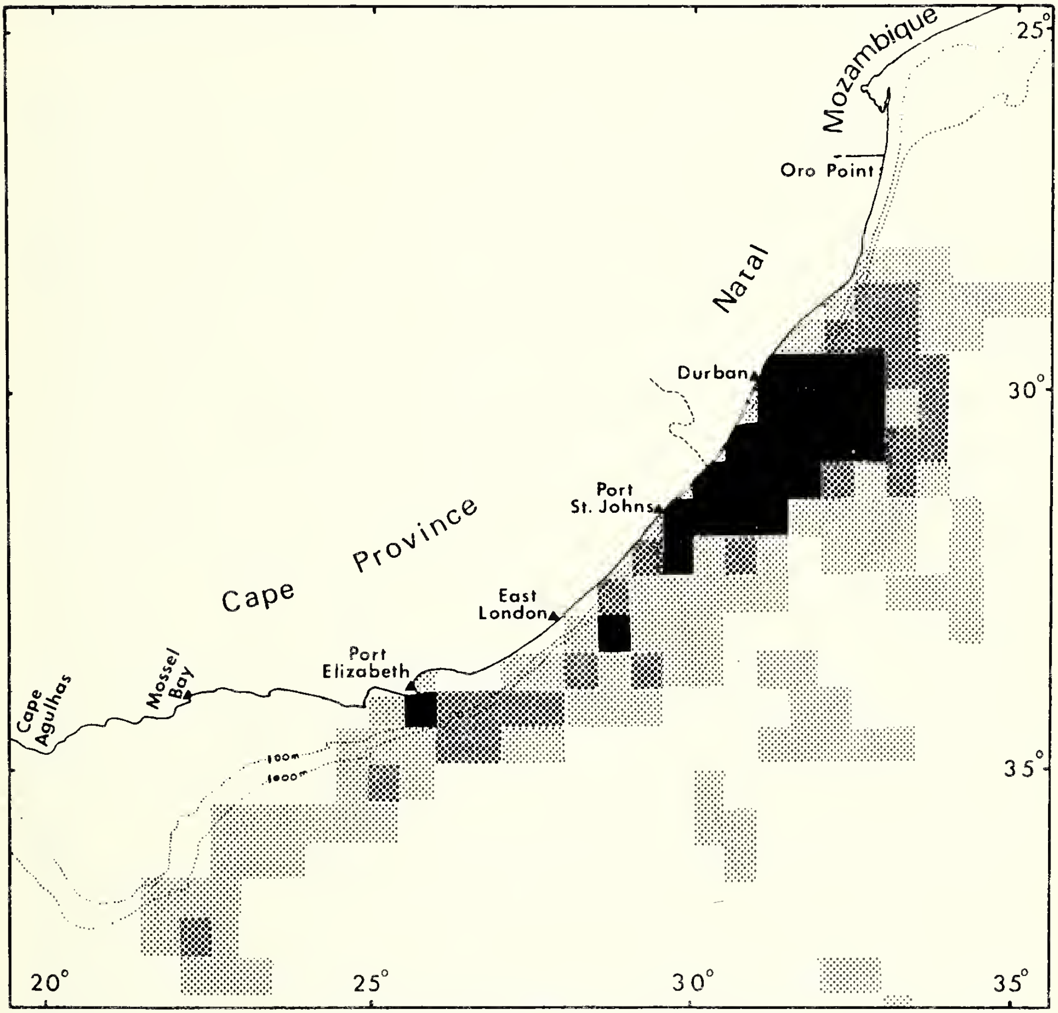


Fig. 43. Area surveyed off the SE coast of southern Africa during six whale-marking cruises (data from IOS, 1969, 1971, 1972, 1973, 1975; Gambell *et al.*, 1975). The distance traversed in each quarter degree square in daylight hours is represented by shading—

░ 0–50 nautical miles; ▒ 50–100 nautical miles; ■ >100 nautical miles.

## SUMMARY

The small cetacean fauna of the SE coast of southern Africa includes 24 species of odontocetes. More important points of interest arising from the analysis of new data from some 350 animals derived primarily from strandings and from sight records, previously unpublished records and the literature are as follows:

1. A study of the tympanic bullae confirmed that *Mesoplodon hectori* is correctly placed in that genus.
2. Southern and northern hemisphere populations of *Mesoplodon mirus* were shown to differ in three cranial features, possibly indicating sub-specific differences. The structure of the teeth suggests that age determination using dentine layers will be limited to young animals.
3. No differences were found in the cranial morphology of *Mesoplodon densirostris* from the North Pacific, North Atlantic and southern African regions. Colour patterns of adults and a foetus are described. The structure of the teeth is described in relation to age determination, and reproductive data are provided for three females and one male. Oceanic fish remains were found in one stomach. There is no evidence of seasonality in the occurrence of *M. densirostris* on the SE coast.
4. There is some evidence that dentine and cement layers in the teeth of *Ziphius cavirostris* are deposited at the same rate. Two stomachs of this species contained beaks of oceanic squids and benthic fish, from which deep-diving ability is inferred.
5. A re-evaluation of data on *Berardius arnouxi* and *B. bairdi* suggests that these two species are probably conspecific.
6. The colour pattern and other features of the first recorded calf of *Hyperoodon planifrons* are described. This species appears to occur seasonally in these waters in the summer months.
7. The specific status of *Kogia breviceps* and *K. simus* was confirmed in a previous study (Ross, 1979) and in the present study in which data on growth, reproduction, feeding and seasonality are provided. The proportions of oceanic and near-shore cephalopods in stomachs of both species suggest that immatures and mother/calf pairs feed closer to shore than adults, over the edge of the continental shelf and upper part of the slope.
8. Comparison of North Atlantic and southern African *Orcinus orca* supports previous opinion that these populations are conspecific. The first record of a swordfish bill in an odontocete is described for a sub-adult male *O. orca* and is related to abnormal tooth wear in this specimen.
9. A catalogue reference to cephalopod beaks in the stomach of a *Feresa attenuata* provides the first data on prey taken by this species under natural conditions.
10. *Globicephala melaena* and *G. macrorhynchus* have allopatric distributions which overlap in this region (van Bree *et al*., 1978) though both species appear to be rare in the area. It is suggested that these distributions may be the result of competition.
11. The status of *Grampus richardsonii* Gray as a junior synonym of *G. griseus* is confirmed. Southern African *G. griseus* appear to be shorter than those from the North Atlantic or Mediterranean. Stomach contents consisted only of cephalopod remains. Throughout the year this species occurs beyond the 100 m isobath.
12. Additional material confirmed previous findings that two forms of *Tursiops* occur in this region (Ross, 1977). *T. truncatus* apparently occurs beyond the 200 m isobath. *T. aduncus* is a neritic species. The species are distinguished by external and skeletal features.
13. The rate of dentine deposition was indirectly estimated from growth data and teeth of captive animals at one layer per year in *T. aduncus*. Dark ventral spots develop ontogenetically in *T. aduncus* from Natal whereas few eastern Cape animals are spotted, indicating that these two populations are discrete.

14. *Delphinus capensis* Gray is shown to be a junior synonym of *D. delphis* Linnaeus. In this region *D. delphis* shows a preference for shoaling fish, particularly clupeids, and in winter migrates eastwards to Natal waters during the annual 'sardine run'.
15. Variations in the colour pattern of striped dolphins of the genus *Stenella* in this region confirm previous studies suggesting that these dolphins belong to one species, *S. coeruleoalba* (Meyen). Myctophids constituted two thirds of all recorded prey. The distribution of *S. coeruleoalba* in this region is correlated with the warmer waters of the Agulhas Current.
16. Skeletal and external data for spotted dolphins in this region confirm that they are conspecific with *Stenella attenuata* from the Indo-Pacific region.
17. A specimen of a neonatal dolphin referred to *Stenella longirostris* provides the first record of this species in this region for over a century.
18. Additional material of *Lagenodelphis hosei* from this region supports previous opinion that all Indo-Pacific specimens are conspecific.
19. On cranial and external characters, specimens of *Sousa* from the SE coast are referred to *S. plumbea* until further data are available on other species in this genus. Southern African specimens are intermediate in some characters between Atlantic *S. teusii* and northern Indian Ocean *S. plumbea*. It is suggested that the distribution of this species is extended westwards along the coast of southern Africa due to the presence of warm water in the sheltered bays of the southern Cape coast.
20. The species diversity of small cetaceans in this region is high. The fauna includes four distributional components. These are a tropical/sub-tropical component associated with the Agulhas Current, a temperate/sub-antarctic component, a cosmopolitan component, and a 'mixed water' component including two species which are apparently confined to the area of mixing cool and warm water.

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